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Cutting and Soluble Oils

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CUTTING lubricants, also called cutting and soluble oils, and cooling liquids, known as coolants, are oils or emulsions used in metal-cutting operations to protect the tools and to reduce the temperature produced by the friction and shear at the point of tool contact. In machining some materials it is impossible to obtain a proper degree of finish without the use of a cutting lubricant, while with others the application of the lubricant permits a higher cutting speed and a more rapid rate of production than when no lubricant is used. According to their composition, cutting lubricants may be divided into four main classes: Cutting oils, water-soluble oils, soluble compounds or "cutting compounds," and cutting emulsions. Cutting oils are oils such as lard oil, sperm oil, rapeseed oil, castor oil, or mineral lubricating oils; or they may be mixtures of light mineral oils with vegetable or animal oils. In all cases such oils when used as cutting oils are free from the presence of either water or soap. Ordinarily, these oils do not form emulsions with water. Water-soluble oils are only liquids that form emulsions when mixed with water. This property of emulsifying when mixed with water usually is due to the presence of a water-soluble soap. Sodium, potassium, or ammonium soaps of either fatty oils or fatty acids, rosin oil, sulphonated fatty acids, or naphthenic acids may be used. To this mixture of soap and mineral oils may be added ammonia, naphtha, or alcohol, in some cases with simultaneous oxidation by air.

If the emulsifying properties of a water-soluble oil are not due to the presence of an alkaline soap, then the soluble oil may be a product of the sulphonated oil type. Sulphonated oils are fixed oils that have been treated with sulphuric acid, and the excess acid washed out, so that only the product of the reaction, or sulphonated oil, remains. Mineral oil is then incorporated with the sulphonated oil up to the desired proportions. For making sulphonated oils the use of castor oil probably gives the best results, but other vegetable oils, such as corn oil, also can be used, either compounded with the castor oil or alone. Soluble compounds, or cutting compounds, are greasy pastes which emulsify when mixed with water. They are made in a manner similar to the procedure followed in making soluble oils, except that usually they contain from 10 to 70 per cent of water, and are in a semi-solid or semi-emulsified condition. Cutting emulsions are aqueous emulsions formed by mixing soluble oils or soluble compounds with water in varying proportions. Regardless of the kind of base that is used to form the cutting emulsion, the soluble oil or cutting compound should be readily miscible with water and should form a stable emulsion without having a tendency either to settle or to decompose upon exposure to the air for long periods of time.

Cutting lubricants and coolants for use on metal cutting tools vary with the nature of the work to be done. The author of this article gives some of the fundamentals to be observed in selecting the right compound to use for any specific work, and the proper method of handling the oils

In general, the services required of cutting or soluble oils when used on machine tools are: Cooling, lubricating, flushing out the cutting area, producing a smooth finish, and protecting the finished product from rust and corrosion. Cooling means reducing the temperature both of the tools and the material being machined.

Cooling. A large amount of frictional heat is generated when metal is cut as a result of the slipping of the metal chip over the face of the tool, by the separation of the chip from the main body of metal, and by the "crimping" of the chip. Errors in the dimensions of the

The first of three articles. The second article will appear in an early issue.

finished product occur when measurements are taken on the heated material, which contracts on cooling and causes the dimensions to be different from those originally taken. Furthermore, frictional heat causes the sharp cutting edge to wear and dull rapidly. As a result of this, production is lessened, and the cost of operation is increased due to the time and labor that is required for regrinding the cutting tools. Cooling, therefore, is a primary requisite of a cutting lubricant.

Lubrication. Cutting lubricants furnish lubrication between the lip of the tool and the chip, thus reducing friction, and therefore lessening the amount of heat generated and the power required for the cutting operation. Ordinarily lubrication is of little importance where the article being machined is made of brittle, granular material, where the material is removed in the form of powder or fine chips that do not tend to clog the cutting edge. However, lubrication is very important when the metal is tough and forms continuous, spiral shavings, as this causes much frictional heat due to the shavings clinging to the tool and rubbing over its faces. Lubricating the nose of the tool is all the more necessary when the metallic friction is increased while cutting tough materials, so that the tougher the material the greater is the necessity for a lubricant. If proper lubrication is not being accomplished, the shavings produce such friction that the life of the cutting tool is lessened and a rough finish will be produced on the material being cut.

Flushing out the cutting area. In many cases cutting lubricants must assist in carrying away the chips, shavings, and other particles that have been detached by the tool. The flushing out of the cutting area and freeing it of small metallic particles should be accomplished as rapidly as possible. This is necessary so that the wear on the tool will be reduced to a minimum and the finish on the part being machined will be preserved. Removal of the fine chips is especially necessary when deep holes are being drilled, and in such milling operations where, if chips and dust were allowed to accumulate, the cutting efficiency of the tool would be reduced and the finished surface might be scored.

Effect on Finish

Producing a smooth finish. Generally speaking, when a cutting oil lubricates and cools the cutting surfaces properly, the material being cut will possess a smooth finish. However, when a perfect finish on the machined part is desired, cutting oils possessing great oiliness or greasiness must be used. For this purpose animal or vegetable oils either alone or compounded in high percentages with mineral oils are usually employed. Producing a smooth finish is really a matter of lubrication, for the application to the cutting surfaces of a continuous stream of cutting oil serves to give smooth action to the cutting tool, and prevents chatter and uneven strain upon the work.

Protecting from rust and corrosion. Cutting lubricants, free from water or a large percentage of free fatty acids, frequently are used to prevent rusting and corrosion of metal surfaces. Fatty acids have a corroding effect, and form verdigris when allowed to remain in contact with brass and copper surfaces, and for this reason cutting oils used for this purpose should contain a minimum quantity of uncombined fatty acids. Cutting emulsions, made by mixing cutting compounds or soluble oils with water, cause rusting if they are used in dilute solutions, or if they contain acid. Generally, however, rusting is avoided when the proper grades of lubricants are used, and is most apt to occur only when poor grades of soluble oils are employed, or when a very dilute water solution is being used.

The so-called "straight" cutting oils may be classified as follows:

1. Pure animal oils, such as lard oil, fish oil, sperm oil, whale oil, wool grease or tallow.
2. Pure vegetable oils, such as castor oil, cottonseed oil or rapeseed oil.
3. Pure, straight mineral oils of relatively low viscosity.
4. Mineral oils compounded in various percentages with either animal or vegetable oils.

In general, it may be said that animal oils, particularly the various grades of lard oil, are the most important of all the oils used in machining operations. Animal oils are very oily and greasy, are of a low viscosity, and because of the fluidity of most of them they are excellent coolants for high-speed work. Fatty oils of this class are used either straight, sulphonated, or in the form of emulsions; for the most part, however, they are compounded with mineral oils, and as such are used as cutting lubricants.

General Use of Lard Oil

As a cutting oil, lard oil is the most commonly used animal oil, being employed either in its pure form or compounded with mineral oil. Various grades of lard oil may be purchased for use in cutting operations, the grades known as prime lard oil and extra No. 1 lard oil being the two which most frequently are used. Prime lard oil is the best grade of oil. It is nearly colorless, having only a faint yellow or greenish tinge. The cheaper grades are more heavily colored, contain a larger percentage of free fatty acids, and therefore tend to decompose more rapidly than does prime lard oil.

Lard oil is very oily and hence is a very suitable cutting lubricant where tough materials such as steel are being machined or where a high degree of finish is to be produced. All lard oils thicken when cooled and congeal at low temperatures. For this reason they are somewhat deficient in cooling properties, since the oil cannot penetrate readily into the cut at high speeds. In spite of this fact lard oil is superior to most straight mineral oils in its cooling capabilities, even though after extended use in a circulating system lard oil thickens and loses more of its cooling property.

Sperm oil is a better coolant than lard oil, since it has a lower viscosity, but because it is very expensive it is seldom used except for the smallest and most delicate work. The oiliness of sperm oil is less than that of lard oil, but nevertheless it can be used successfully in making light cuts on tough or very brittle material and at higher speeds than usually is permissible with the use of pure lard oil.

For some special machining operations pale whale oils are sometimes used. The dark whale oils are not always well suited for use as cutting lubricants and therefore are seldom used. For use as cutting lubricants whale oils are nearly always mixed with a small percentage of mineral oil, because of the tendency of whale oils to evaporate or dry more rapidly than the other animal oils when used alone. Fish oil is seldom used alone as a cutting oil, but frequently is compounded with lard oil and as such is employed as a cutting lubricant and coolant. Some government specifications allow the presence of up to 10 per cent of fish oil in cutting oils.

Vegetable oils possess a high degree of greasiness, and it is this particular characteristic that makes them superior to either animal or mineral oils as cutting lubri-

cants. Their use is especially advantageous when a high degree of finish is desired. However, when used in their pure state they are not very suitable coolant oils, because of their relatively high viscosity, and for this reason they usually are compounded with low viscosity mineral oils when they are used on high speed machining operations.

Vegetable oils are not well adapted for use in circulating systems since they oxidize more readily than do either the animal or mineral oils. As a result of this oxidation, gummy deposits are formed that clog the circulating system and interfere with the production of the machine. Vegetable oils, however, may be used satisfactorily as cutting lubricants after being compounded with mineral oil or after having been mixed with water to form an emulsion.

Castor oil is a very viscous oil and possesses a high degree of oiliness. For this reason it is suitable for use on very tough materials, especially where great accuracy must be obtained such as in boring and machining guns. In addition to the great accuracy that is made possible by the use of castor oil, it also will produce a high degree of finish on the part being cut. Owing to its high viscosity, however, even for use at moderate cutting speeds it must be diluted with some other oil, usually with a low viscosity mineral oil. Castor oil is classed as a non-drying oil. It has the highest viscosity of all known natural fatty oils and has a Saybolt viscosity at 100 deg. F. generally between 1,000 and 1,300 seconds. This vegetable oil is used frequently either in the hydrolyzed or sulphonated form to make water-soluble oils.

Cottonseed oil is classed as a semi-drying oil. It is often used alone to obtain a finely finished surface, but it is more often apt to be compounded with a mineral oil and used as a cutting lubricant. It is not suitable for use in circulating systems because of its drying properties and the rapidity with which it tends to oxidize. It may be used satisfactorily, however, for slow, heavy cuts in tough material.

Rapeseed oil is classed as a semi-drying oil. It usually is used for machining operations under the same conditions as cottonseed oil; that is, for a slow speed, for heavy cuts, and for obtaining highly finished surfaces. Although it does not oxidize as rapidly as cottonseed oil, nevertheless it should not be used in circulating systems. Rapeseed oil mixes in all proportions with mineral oil, and therefore can be compounded without any difficulty.

Objections to Animal or Vegetable Oils

Lard oil, used alone, is the oldest form of cutting lubricant, and usually is applied with a squirt can directly upon the part being machined. One of the main objections to the use of lard oil, or any other animal or vegetable oil, is that the free fatty acids which are present in most fatty oils, and which develop in additional amounts when the oil is exposed to the temperatures attained during operations, will pit and attack the metal surfaces if the oil is allowed to remain in contact with the metal for any appreciable length of time. Another objection is that after the oil has been re-used a number of times, as in circulating systems, it deteriorates in value as a cutting lubricant, and more especially so in its effect as a coolant. Moreover, all fatty oils are very expensive if used alone, so that the high cost is one of the foremost objections to their use for this purpose. In addition to these objections it might be mentioned also that in cutting or boring material made of brass it is difficult to remove the fine brass dust from the fatty oil after it has passed over the part being machined.

Mineral oils are occasionally used alone as cutting lubricants, but in general do not produce as satisfactory results as when they are compounded with varying proportions of fatty oils. Such mineral oils as are used are of relatively low viscosity, this usually ranging between 100 and 200 seconds on the Saybolt viscosimeter. Oils of low viscosity are more adapted for use under slow-speed conditions. When mineral oils are used for this purpose it is essential that they are not of too low a viscosity; otherwise, they are apt to be too volatile, thus causing objectionable smoking and fuming because of vaporization of a part of the oil when exposed to the heat of the tool.

Using Compounds

Although mineral oils of high viscosity have slightly more oiliness than the low viscosity oils, nevertheless if an increase in the oiliness of a cutting lubricant is desired it is better to compound a definite percentage of fatty oil with a low viscosity mineral oil rather than to use a straight mineral oil of higher viscosity. However, when the use of a compounded oil is not desirable, and a straight mineral oil having a maximum oiliness is required, then as high a viscosity mineral oil should be used as will be permitted by the cooling requirements of the work.

One advantage of the use of an oil of high viscosity is that less oil spray is formed and therefore less oil is wasted either by splashing or leakage. The two main disadvantages to the use of high viscosity mineral oils are: 1. There is greater inclination for the heavier oil to hold metal chips in suspension than when mineral oils of lower viscosity are used. 2. The cooling properties of the cutting lubricants are diminished by the use of high viscosity mineral oils; for upon the fluidity of the oil depends to a great extent the rapidity with which the oil removes heat and radiates the absorbed heat. The use of mineral oils of low viscosity is nearly always most advantageous; for then the cutting lubricant has fairly good cooling properties and is readily made fit for further use by removing any metallic impurities that may be present in small quantities either by settling out by gravity or by filtration.

Dignifying Letters of Recommendation

By John Homewood

THE writing of a letter of recommendation should not terminate the writer's interest in the welfare of the one recommended or in the one to whom he or she is recommended. If it is possible to get in touch with the employer who has employed someone through your intercession, do so and inquire as to his or her satisfaction. The matter of recommendations is not taken seriously enough; to some, a letter does not bear any weight. An inquiry following employment is just as important to the one who does the recommending as the recommendation is to the one seeking the position. It upholds the honor of the one doing the boosting. If we are a little more careful in giving a recommendation and follow it up with a showing of interest in the welfare of the employer and employee, letters of recommendation will again assume their position on the pedestal of honor.

Book Reviews

DEVELOPING AND MANAGING SALESMEN. By Ray Giles. Two hundred and sixteen 6 x 9-in. pages, cloth boards. Published by the Ronald Press Co., New York City. Price $3.50.

THE author of this book has taken his subject matter from a long and varied experience as a consultant on advertising and selling problems. In his text he attempts to throw light on the more personal side of sales management; and he succeeds admirably.

He begins with the hiring of salesmen, going thoroughly into the setting of standards and qualifications; then to training methods; and finally to actual selling practices. Instead of the usual theoretical preachments, the author relates many concrete examples to illustrate the points made in the discussions. He even takes up such seemingly unimportant subjects as "what Do Your Salesmen Do While Waiting for Trains?"—and proceeds to show how such time can be put to good use by the man who is wide awake to the opportunities of his job.

This book would make an interesting manual for the salesmanager. It is easy to read because of its interesting style of narrative.

PERSONAL HEALTH. By Emery R. Hayhurst. Two hundred and seventy-nine 6x9-in. pages, cloth boards. Illustrated. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $3.

IN THIS small book the author and publishers have provided a practical medical adviser for use by the individual as well as those responsible for the health and usefulness of others.

It is written without the use of medical terms except where their use is unavoidable. When such terms are used they are explained.

It is the author's belief that probably 75 per cent of common afflictions can be warded off, or controlled, through hygienic and medical knowledge, and that the individual must be his own guardian before most diseases begin, or in their early stages, by knowing how to act to fortify himself.

Occupational diseases are given consideration, although not to the exclusion of full treatment of principles and fundamentals.

BUSINESS WITHOUT A BUYER. By William Trufant Foster and Waddill Catchings. Two hundred five pages, 5¼x6 in., cloth-board cover. Published by Houghton Mifflin Co., 2 Park St., Boston, Mass. Price $2.

TO CONSERVE prosperity and to sustain employment, according to the authors, there is one means, without which all other means are largely futile, and that is to see that the people receive enough income week in and week out, and not very much more than enough such income, in addition to what they save, to buy all the finished products of home industry about as rapidly as they are ready for sale. In the future, we must provide as effectively for financing consumption as in the past we have provided for financing production. Therefore, since underconsumption is the chief cause of troubles, adequate consumer income is the chief remedy.

Thus, in brief, is summarized the theory of the authors. Mention is made that there may be a distressing lot of one product on the market, whereas another product may be comparatively scarce. On this basis, the conclusion is drawn that all goods cannot be relatively overproduced. Such is the classical argument, typical of much economic theory, in that it concentrates attention on goods and overlooks the effects of money.

Ten chapters are included in the volume, among which are: Business under the curse of Sisyphus; Under-consumption as a Basic Cause; The Dilemma of Thrift; Buyers Without Money; How Capital Growth Provides Business With the Buyer; Foreign Trade; Stabilizing the Buyer's Dollar; and Henry Ford's Policies. Throughout the book, the authors are concerned with the means of protecting producers from a slump of business in general due to a net deficiency of demand, rather than with the means of protecting producers from troubles that are peculiar to their individual industry.

MACRAE'S BLUE BOOK AND HENDRICKS' COMMERCIAL REGISTER. Twenty-three hundred and sixteen pages, 11½x9 in. Cloth boards. Published by MacRae's Blue Book Co., 18 East Huron St., Chicago. Price $10.

THE eighteenth annual volume of MacRae's blue book has appeared for 1927 as a consolidation of the two well known and authoritative commercial directories, MacRae's Blue Book, and Hendricks Commercial Register. It contains the best features of both directories combined under the one cover.

In the first part of the directory 255 pages are devoted to a complete list of the names and addresses of the important manufacturers, producers, and wholesalers in the United States, alphabetically arranged. The classified material section, containing 1,747 pages, gives the names of makers and wholesalers of materials, equipment, and supplies under alphabetically arranged headings. The system of headings used is designed to do away with any need for consulting an index or number system before referring to the lists.

A very valuable feature of the combined directory is the trade name section, to which 215 pages are devoted. This section lists alphabetically the important trade names used in industry in the United States, giving the name and address of the manufacturer, and makes a ready means of locating a product when only the trade name is known. The book is well arranged and complete, and should make a useful guide for the purchasing department and engineering office, or for anyone requiring information on equipment, machinery and materials.

EXPORTS, IMPORTS AND CONCESSIONS OF THE SOVIET UNION. Nine hundred twenty pages, 8x10½ in. Cloth-board covers. This book, which is in four languages, English, Russian, German and French, is an official volume intended to furnish American business men with general trade and industrial information on the Russian Socialist Soviet Republics. It has five general parts subdivided into a total of more than sixty articles, each printed in the four languages and giving data on foreign trade, financing, exports, and imports of various commodities, production of goods, concessions covering particular industries, tariff regulations and information on political requirements for the entry of foreigners. The book is published and circulated by the Amtorg Trading Corp., New York City.

Building Large Machine Frames in One Piece by Welding

By Robert E. Kinkead
Chief Engineer, Welder Division
The Lincoln Electric Co., Cleveland

Many of the limitations involved in the use of castings are done away with if welded steel is substituted where practicable

IN RECENT years there has been a marked tendency to make as many parts of a machine as possible, a permanent part of the frame. In welded steel construction, the designer has greater freedom in this direction than if he were using castings. The designer using castings is limited by foundry practice while the designer using welded steel construction is limited only by the necessity for removing such parts as must be removed because of wear or breakage.

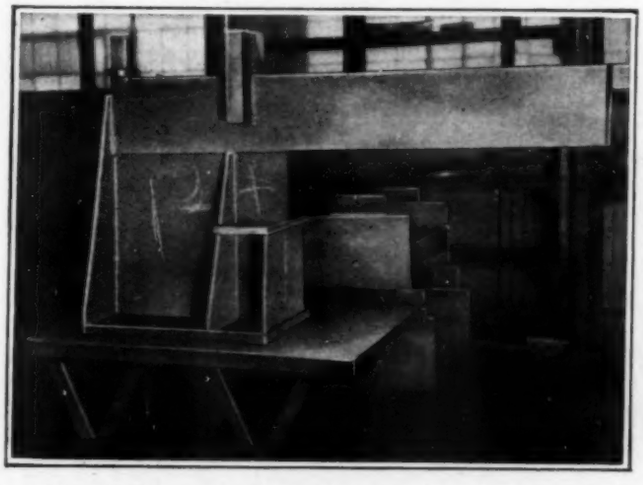
The accompanying illustration, Fig. 1, shows an example of a welded steel machine frame, manufactured by The Lincoln Electric Co., Cleveland, which would be difficult to make all in one casting. There is some saving in machine work on this welded piece by elimination of surfaces to be machined so that parts may be bolted together to form the complete assembly. Machining the welded piece as a whole also gets away from some difficulties in holding to small tolerances that would occur if the piece were made of an assembly of castings bolted together.

The use of steel for machinery frames introduces another element of freedom for the designer which he did not have in the case of castings. To design a whole frame in one casting laid the designer open to criticism on the grounds that breakage of a part of the casting would mean scrapping of the machine since practically the whole machine would have to be replaced. The argument that the cast iron frame could be welded answered the objection in many cases but there is always the possibility that the welded cast iron frame will have to be re-machined after welding because of the distortion resulting from the application of the welding heat. On the other hand, it is pointed out that the steel frame, all welded together, is practically unbreakable. The worst that could happen in case of accident would be that the metal would be distorted or bent.

Warpage of heavy and complicated castings that have not been properly seasoned is a source of occasional difficulty. Welded steel structures are not subject to the same trouble. However, considerable care must be exercised in the manufacture of welded steel machinery frames to avoid serious warping from the welding heat.

Since the welded steel piece is treated merely as the equivalent of a rough casting, some distortion is permissible because the machining of the pieces will compensate within reasonable limits. The usual methods of overcoming distortion troubles are: use of fixtures in assembly; adjustment of sequence of welding to compensate the distortion; peening the welded metal to relieve residual strains which cause distortion; straightening with clamps.

A simple fixture is shown in Figs. 2 and 3 in place on a heavy machine frame being made of welded steel construction. Simple fixtures of this nature are used to a



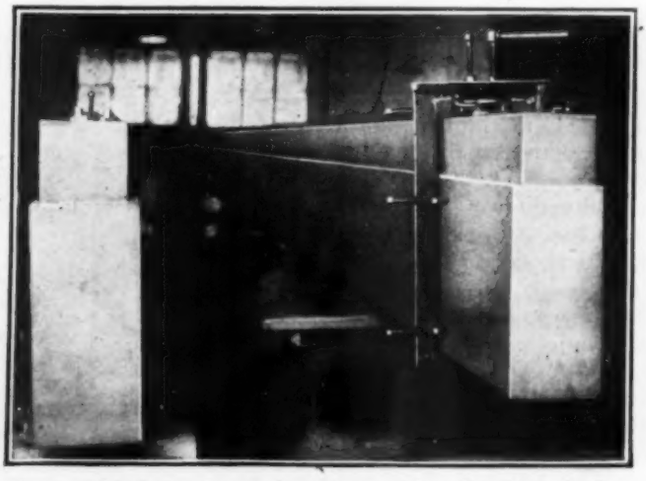


Fig. 1—Large machine frame made all in one piece using welded steel construction. Fig. 2—Shop-built welding fixture used for location of details in assembly of welded steel machines

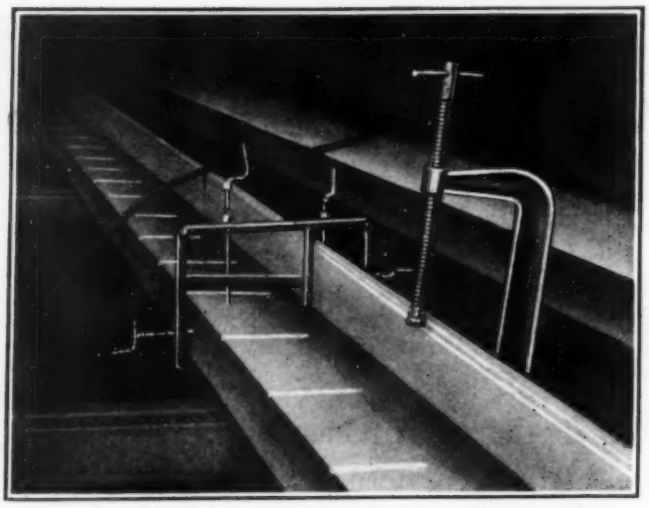


Fig. 2—Shop-built welding fixture used for location of details in assembly of welded steel machine

considerable extent in placing the welded parts in the proper relation to each other in the welded assembly. In the particular instance shown, machine work is eliminated entirely by use of cold-rolled steel and the fixture for close assembly. The permissible tolerance is great enough in this case to allow the use of cold-rolled steel surfaces on the top rails with careful alignment.

There is probably no feature of the welded steel construction method for heavy machine frames more attractive to the designer than the ease with which changes may be made. The rapid improvements which are made in machinery result in heavy expense for patterns in many cases. The welded steel type of construction is built direct from the drawings so that no pattern expense is involved in changes of design. Several cases are known in which radical alterations of machines in course of construction have been made in welded steel design without scrapping any material or involving any expense above the amount which would have been charged to the job had the new design been employed in the first place.

While welded steel construction is new in some lines of equipment, a considerable amount of equipment is being built by this method at the present time and it is meeting with increased favor among machine designers.

Musings of an Old Timer

By H. L. Wheeler

SOME machinists sharpen drills and other tools, but seldom ever think of sharpening a tap.

Why do we have several different tapers in use in machine shops when one standard taper would serve all practical purposes and save money?

Why do some shop managers compel men to stand all day on cement floors, and then boast about efficiency?

Why is a vacation good for office help and anathema for shop help?

Why do so many shops have poor lighting for their workmen and elaborate cost accounting systems at the same time?

Seen and Heard

By John R. Godfrey

Trade-in allowances on machine tools

TRADE-IN allowances have a lot to do with sales of machine tools as well as automobiles. For few of us can resist the lure of what seems to be a liberal allowance on the old machine. Instead of being suspicious, as we should, we fondly imagine we've found a generous hearted dealer at last, and quite forget that when we appear to be getting something for nothing, it's time to watch our step.

I saw a case of this not long ago. The shop had been a pioneer in trying out some newly developed machines when they first came on the market. There had been a few "bugs" to be worked out—as in all new machines—but on the whole they had been very satisfactory, had given good service and paid for themselves many times.

But they were being replaced by machines of another type and make. And almost entirely because of a failure to agree on a trade-in allowance.

The machines were still serviceable in spite of their age and the work that had been done by them. But the user did not feel like consigning them to the junk pile. He felt that the builder should make a good trade-in allowance for them.

But just look at the builder's side for a moment. Of what real value is the machine to him?

"Rebuild it," says the customer, "and then sell it to someone else." But this isn't such a simple thing.

The machine has been largely redesigned since the ones in question were built. Few of the new units could be used without modifications. And making special parts is an expensive job in any shop. But even if the machine could be rebuilt to a satisfactory condition—it would have to be sold for much less than a new machine, else why buy it? Then, too, the rebuilt machine might easily prevent the sale of a new one.

Considering these conditions, is it either wise or profitable for the maker to attempt rebuilding it? Could he get enough for it to pay for his work in reconditioning it, plus any trade-in allowance that would be worth while? And, unless he can rebuild the machine so as to show a profit, including his allowance on the old machine, is it good business even to consider it?

Trade-in allowances have their lure to most of us. We sometimes accept them when we know the old machine will be scrapped and that the scrap value is almost nothing. We have known people to buy an old typewriter or sewing machine for a few dollars to turn in because of a standing allowance that made it save them a little money to do so. We know this is simply one way of getting a cut-price that company policy will not allow to be made openly and honestly.

If the used machine has paid for itself, and most of them have, why should we expect the maker to cut his price on a new one? If it still has more miles, or, work, in it, why isn't it our job to sell it and not the maker's?

And yet some of us feel it a personal grievance when a machine or an automobile builder has backbone enough to refuse to cut his prices by excessive trade in values, or otherwise.

Automotive Production

Methods of Machining Pistons for Airplane Engines

By Fred H. Colvin
Editor, American Machinist

Fixtures, tools and methods of the Curtiss Aeroplane and Motor Co. that are well adapted for use in shops having a limited production

THE pistons used in the Curtiss airplane engines are made of an aluminum alloy and have a somewhat shorter skirt than is common in automobile practice. The machining methods are, however, much the same as to sequence, but differ in both fixtures and equipment because of the comparatively limited quantity produced.

Before any machining operations are performed on piston castings, they are heat-treated to "grow" them. The castings are then shaken with steel balls, being given vertical motion. This operation removes all loose particles and has a peening effect on the insides. An expanding mandrel, or inside chuck, is used in the first operation, as shown in Fig. 1. Inside of the piston head the hardened steel stud *A* locates the piston in regard to its lengthwise position. The piston is centered by expanding three floating jaws, one of which can be seen at *B*. Each jaw has two serrated and hardened points that grip the inside wall of the piston. The jaws are expanded by an air-chuck control through the hollow spindle of the Short-Cut lathe used. The outside of the piston is rough turned by the tool in the toolpost, while the grooves are cut by the tools at *C* and the head is faced by the tool *D*.

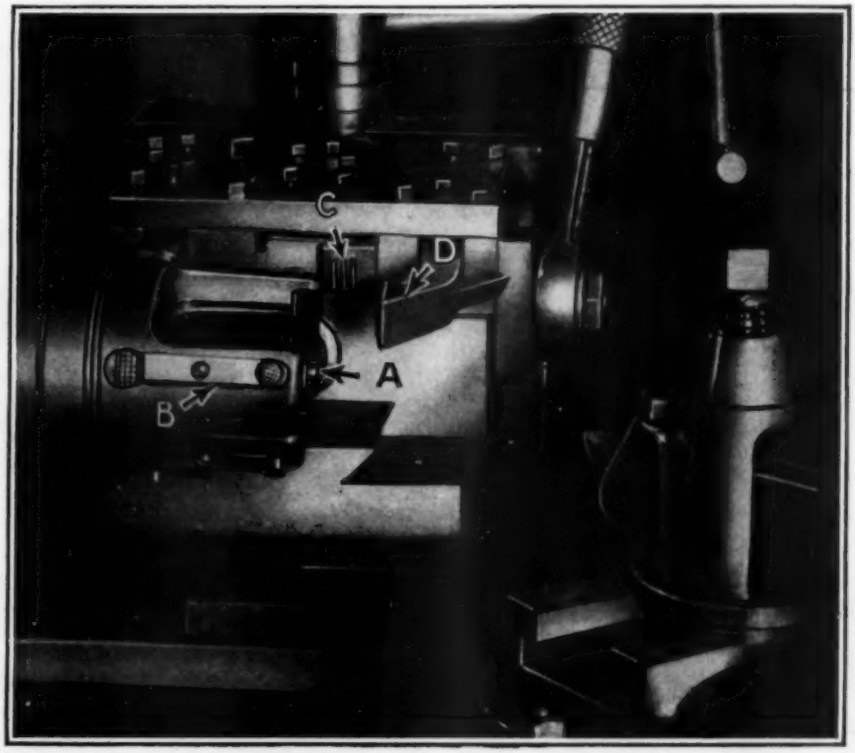


Fig. 1—Mandrel and tools for rough turning

With the rough-turned piston held in a three-jaw chuck having the jaws specially bored to receive it, the open end of the skirt is bored, as shown in Fig. 2. Locating the piston by means of the bored skirt on the projection *A*, Fig. 3, and holding it in position by the clamp *B*, the piston-pin hole is drilled. The clamp support is hinged at *C* and can be easily swung out of the way when the screw is loosened. Suitable projections from the lower plate *D* enter the piston and position the piston-pin bosses so that holes will be drilled in the right position. The piston is

Automotive Production

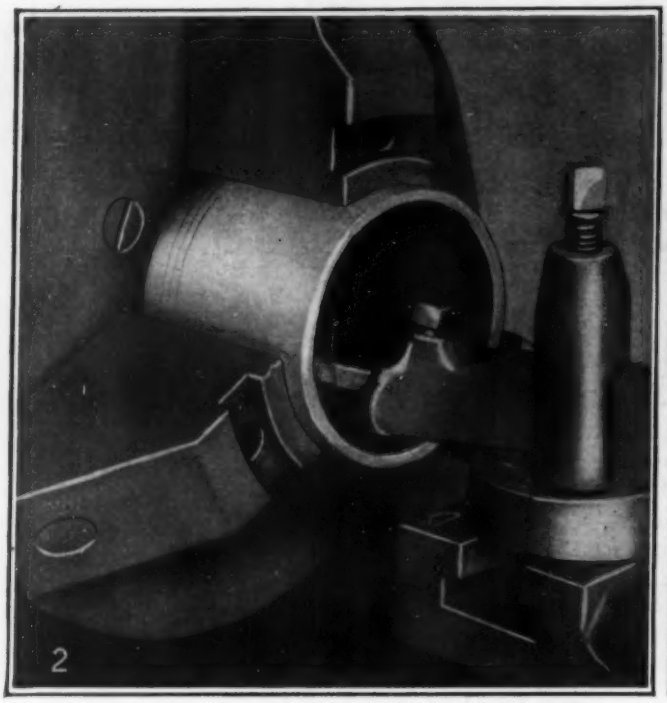


Fig. 2—Boring open end of skirt.

Fig. 3—Drilling piston-pin holes

finish turned, finish grooved, finish faced and the small center hole is reamed, as shown in Fig. 4. The piston is centered by the open skirt fitting over a projection on the mandrel. It is held against a shoulder by air pressure in a cylinder at the rear, acting through a rod that grips a loose pin in the cross hole.

The very simple but effective fixture shown in Fig. 5 is used in finishing the bore of the piston-pin hole. Here the piston is placed with the head down and is centered by the clamping pad *A* that fits in the bored end of the skirt. The cross bar holding the clamp is easily swung out of the way, since one end is slotted for this purpose. The boring bar carries a fly cutter at *B*, and the bar is well supported and guided at each end by bushings in the heavy housings. The drive is through a universal joint, accuracy depending on the fixture.

Still another operation on the piston pin bosses is shown in Fig. 6, that of facing the inner ends and chamfering the outer ends. The piston is held on the small expanding mandrel *A* while the tool *B* faces the inside end of the boss by a cross movement of the tool slide. Tool *C* chamfers the outer end of the hole as shown. This view also shows the ribbing inside the piston. The piston is reversed for facing the opposite boss and chamfering the other end of the hole.

Relief on the sides of the piston is obtained by turning, as in Fig. 7. The piston is held on the mandrel by the usual pull-back device and is centered by the open end of the skirt as before. Cams on the faceplate give the necessary in-and-out motion to the tool to cut the reliefs on the sides of the piston at the proper places. Large quantity production would permit the use of a more rapid

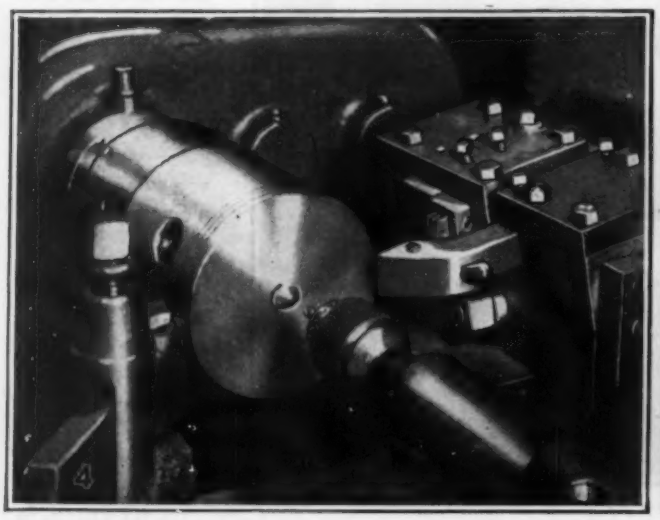


Fig. 4—Finish turning and facing of piston.

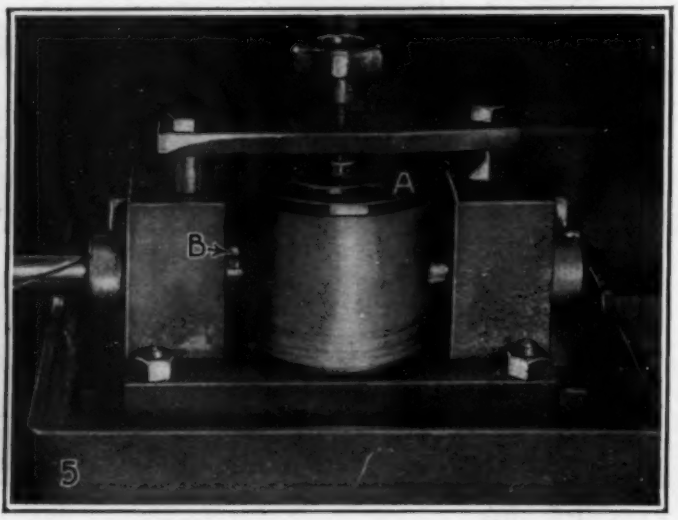


Fig. 5—Final boring of piston-pin holes

Automotive Production

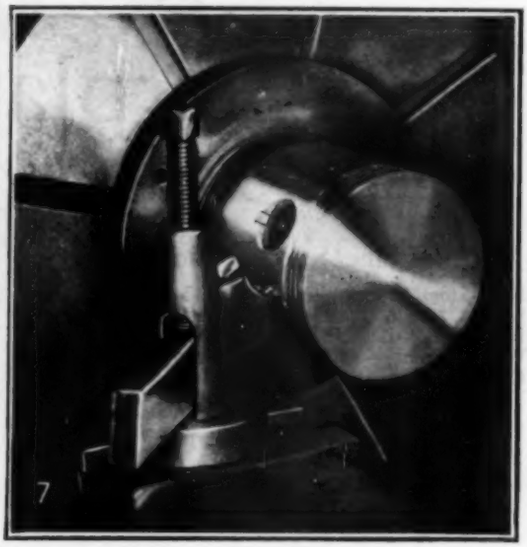


Fig. 6—Facing inside of piston-pin bosses. *Fig. 7—Turning eccentric relief on piston*

method, but this device does the work very satisfactorily and with small outlay for equipment.

Before going to assembly, each piston is tested by air pressure to detect any porosity in the casting that might involve leaks later on. The testing apparatus is simple, as can be seen in Fig. 8. The piston is clamped on to a heavy rubber sheet by the small screw at the top, and air at 30 lb. per sq.in. is applied for the test. The outside of the piston is coated with oil, so that bubbles will be formed if air leaks through the casting.

The Age of Molding

WE HAVE passed through various ages in the history of mechanical progress, ever since the stone age produced the first crude tools. One of these periods, not spectacular like the steel age but nevertheless important, is being experienced by industry right now in the general adoption of production molding of mechanical articles, especially from the synthetic resins. These include the molding of electrical equipment parts, handles, novelties, ornaments, and so on.

The nitro-cellulose compounds are adaptable for many molded articles, but they have the fault that they are inflammable. Then come the phenol resins, which are non-inflammable, electric insulators, easily molded when hot, and cheap, so that they are admirably adapted for radio and other electrical parts. They have the disadvantage, however, that practically no machine work can be done on them after molding because of their hardness. But the casein solids, and certain other synthetic resins, combine most of the properties of the phenol resins with the added factor of machinability.

Each of these synthetic molding materials has its own peculiar properties. It remains only for the manufacturer of parts to select the material best suited to his needs. The main point at issue is that a new element has entered the production shop, namely, the facility with which duplicate parts of various designs and complicated shapes can be made rapidly and cheaply by die molding.

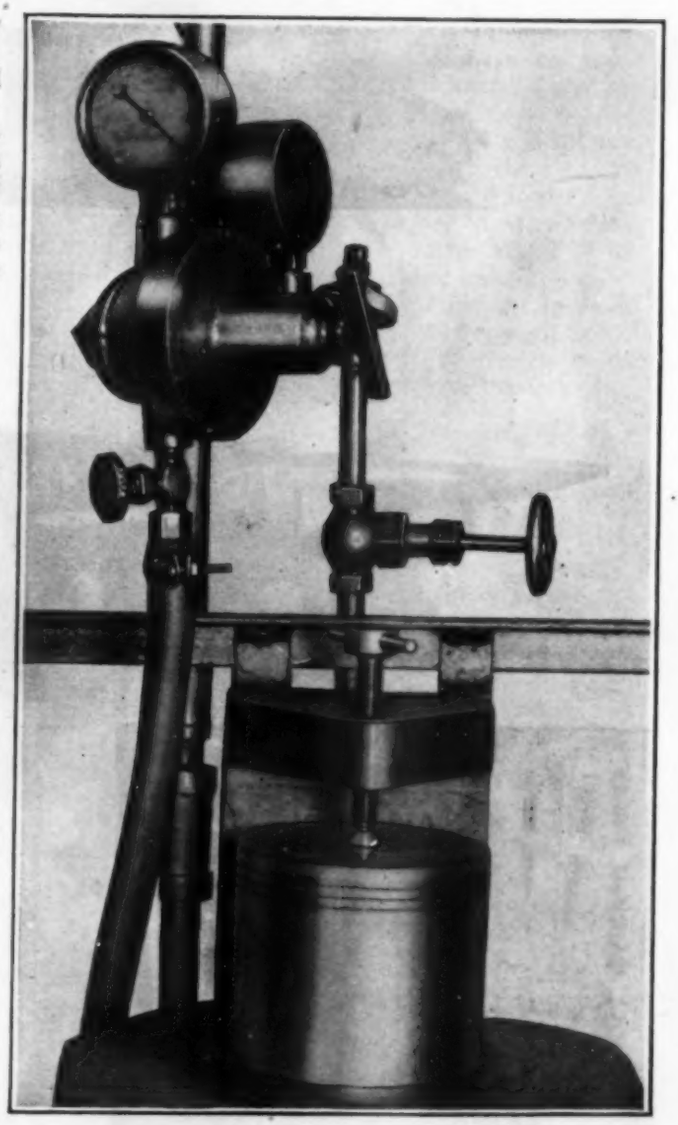


Fig. 8—Testing piston by air pressure

Carrying Freight by Airplane

Plane Specifications

Ford-Stout tri-motored transport, Model 4-AT
Span—71 ft. 5 in. Length 49 ft. 10 in.
High speed—120 m.p.h. Radius of action—500 mi.
Weight, empty—5,750 lb. Useful load—3,550 lb.
Cabin capacity—4 ft. 6 in. x 5 ft. x 15 ft.
Engines—3 Wright Whirlwinds of 225 hp.

Delivery of package goods by airplane to fill emergency orders is believed by George Ed. Smith, president of the Royal Typewriter Company, to be both practical and economical. He backs his belief by putting into service the Ford-Stout tri-motor monoplane shown with Edsel Ford, Commander Richard E. Byrd and William B. Stout standing in front of it. It has racks for 200 portable typewriters, as shown below. They will be dropped by parachute at various distribution points some of which have no landing fields. The plane will work out of Hartford where the Royal factory is situated.

Machining and Measuring Gear Teeth

By EARLE BUCKINGHAM
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Influence of the setting angle of the hob—Side cutting of gear hobs and the limitation on setting angle as determined by height of fillet formed

THE angle β at which a hob is set may be chosen, within practical limits, at random and a hob can be developed to cut a straight-sided rack or involute gear of the desired pitch. The angle β may be reduced to zero which would result in the conditions shown in Fig. 48. Referring to previous equations, we have

$$\tan \alpha' = \frac{\tan \alpha}{\sin \beta}$$

Where α' = pressure angle of hob in plane perpendicular to axis
and α = pressure angle of rack tooth.

When $\beta = 0$

$$\sin \beta = 0$$

$$\tan \alpha' = \frac{\tan \alpha}{0} = \infty$$

Whence $\alpha' = 90°$

Let R = pitch radius of hob
M = module of rack
δ = angle of generatrix of theoretical hob

$$R = \frac{M}{2 \sin \beta} = \frac{M}{0} = \infty$$

$$\tan \delta = \frac{(\tan^2\alpha + \sin^2\beta) \sin \alpha'}{\cos \beta \tan \alpha}$$

$\beta = 0$, whence $\sin \beta = 0$, and $\cos \beta = 1$
$\alpha' = 90$, whence $\sin \alpha' = 1$

$$\tan \delta = \frac{(\tan^2\alpha + 0) \times 1}{1 \times \tan \alpha}$$

$$= \tan a, \text{ whence } \delta = a$$

Thus when the angle β at which the hob is set is equal to zero, the angle δ of the generating line is equal to the angle of the rack. The pressure angle of the involute curve in section *d-d* in Fig. 48 will be 90 deg. and the radius of the pitch circle will be infinity. With screw gears, or helical involute gears whose axes are not parallel, the pitch circles or cylinders of the mating gears are not necessarily tangent to each other. The case just cited is one example of such a condition.

The seventh article. The eighth will appear in an early issue.

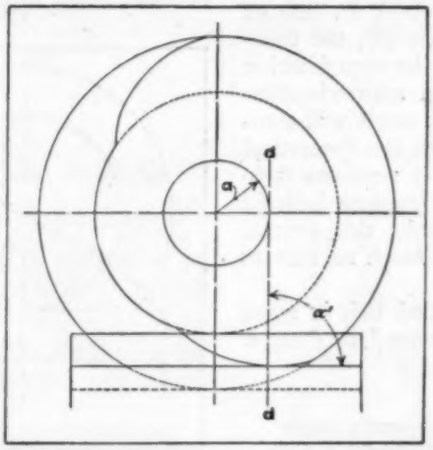


Fig. 48—Diagram of hob set square with rack

When the hob is set with a helix tangent to the tooth of the rack or gear at any given diameter of the hob, the normal thickness of the hob tooth at that point is equal to the width of the space at the mating portion of the rack or gear. In all other cases the space cut by the hob tooth will be greater than the normal thickness of the hob tooth. Therefore, if a predetermined width or space must be maintained, the thickness of the hob tooth must be reduced accordingly when the hob is set to some other angle than that of its helix at some predetermined diameter. This reduction in the thickness of the hob tooth is one limitation in regard to the selection of the angle at which it is to be set. A more serious limitation in this respect, however, is the height of the resulting fillet at the root of the hobbed rack or gear.

Before proceeding further, it is of interest to determine the effect on the form of an involute gear tooth of a variation in the setting angle β. Referring to the equations in the previous article, we have the following:

$$K = \frac{P}{\cos \beta} = \text{lead of hob}$$

Whence $P = K \cos \beta$ = circular pitch of basis rack

$$\tan \delta = \frac{K}{2 \pi a}$$

$a = R \cos \alpha'$ = radius of base cylinder of hob

$$\tan \alpha' = \frac{\tan \alpha}{\sin \beta}, \text{ and } M = \frac{P}{\pi}$$

$$R = \frac{M}{2 \sin \beta} = \frac{P}{2 \pi \sin \beta}$$

Whence $\dfrac{\sin \alpha'}{\cos \alpha'} = \dfrac{\tan \alpha}{\sin \beta}$

But $\dfrac{1 - \cos^2\alpha'}{\cos^2\alpha'} \quad \dfrac{\tan^2\alpha}{\sin^2\beta}$

Whence $\cos \alpha' = \dfrac{\sin \alpha}{\sqrt{\tan^2\alpha + \sin^2\beta}}$

$$a = R \cos \alpha' = \frac{P}{2\pi\sqrt{\tan^2\alpha + \sin^2\beta}}$$

$$\tan \delta = \frac{K}{2\pi a} = \frac{K\sqrt{\tan^2\alpha + \sin^2\beta}}{P}$$

$$= \frac{\sqrt{\tan^2\alpha + \sin^2\beta}}{\cos \beta}$$

Whence $\cos \delta = \cos \alpha \cos \beta$

It will be seen from the foregoing equation that δ is dependent only on the angles α and β.

With an involute spur gear, if the pitch diameter is changed while the involute profile remains unchanged, the module and pressure angle change accordingly but maintain the following relationship:

Let M_1 = original module of gear
M_2 = changed module of gear
α_1 = original pressure angle
α_2 = changed pressure angle.

Then $M_1 \cos \alpha_1 = M_2 \cos \alpha_2$

Whence $M_1 = \dfrac{M_2 \cos \alpha_2}{\cos \alpha_1}$

If this change in the module of the gear is caused by a change in the angular setting of the hob β, the new module will have the following relationship with the original one:

Let β_1 = original setting of hob
β_2 = changed setting of hob

$$K = \frac{P}{\cos \beta} = \frac{\pi M_1}{\cos \beta_1} = \frac{\pi M_2}{\cos \beta_2}$$

Whence $M_1 = \dfrac{M_2 \cos \beta_1}{\cos \beta_2} = \dfrac{M_2 \cos \alpha_2}{\cos \alpha_1}$

$\cos \alpha_1 \cos \beta_1 = \cos \alpha_2 \cos \beta_2$

Referring to a previous equation, we have

$\cos \delta = \cos \alpha \cos \beta = \cos \alpha_1 \cos \beta_1 = \cos \alpha_2 \cos \beta_2$.

Therefore regardless of the angle at which a hob is set, it produces the same involute on the gear being cut. The thickness of the space and tooth will change as the setting angle is altered, and the height of the fillet at the root of the tooth will change, but these will be the only differences.

It is evident that this freedom in choosing the angle at which to set the hob is of great practical value. Machine settings are never mathematically exact, and do not need to be for hobs. The hob may be set to depth and angle by trial to secure the desired tooth thickness, and no theoretical error will develop. Furthermore, the thickness of the hob tooth itself is not important as long as it is not too thick. A slight change in its angular setting on the machine will automatically compensate for any errors in tooth thickness.

A further advantage of this freedom in choosing the setting angle of the hob is the choice it gives of an exact lead for the hob instead of an approximate one. For instance, in a preceding example of a 6-D. P. hob of 3 in. pitch diameter, 14½-deg. pressure angle, the theoretical lead required was 0.52441 in. If the even fraction $\frac{11}{21}$ is used for the lead, this gives an approximation equal to 0.52381 in. A slight change in angle will compensate for any small difference between the theoretical lead and that actually used. All that is required is to have the correct normal pitch on the involute helicoid containing the cutting edges of the hob: this normal pitch is the shortest distance from one tooth surface to the next.

The normal pitch of a single-threaded hob is equal to $K \cos \delta$. This is also equal to $K \cos \alpha \cos \beta$, or $P \cos \alpha$.

Thus when K = theoretical lead of hob
R = pitch radius of hob
α = theoretical normal pressure angle
β = angular setting of theoretical hob
δ = angle of generatrix of theoretical hob
K_1 = actual lead of hob
α_1 = corrected normal pressure angle
β_1 = corrected angular setting of hob, or helix angle at the pitch radius
δ_1 = corrected angle of generatrix of hob.

$$K \cos \delta = K_1 \cos \delta_1$$

$$\cos \delta_1 = \frac{K \cos \delta}{K_1}$$

$$\tan \beta_1 = \frac{K_1}{2\pi R}$$

$$\cos \alpha_1 = \frac{\cos \delta_1}{\cos \beta_1}$$

In the example given,

$K = 0.52441$ in.
$R = 1.5000$ in.
$\alpha = 14\frac{1}{2}°$
$\beta = 3° 11' 5''$

$\cos \delta = \cos \alpha \cos \beta = 0.96815 \times 0.99845 = 0.96665$

$K_1 = 0.52381$ in.

Whence $\cos \delta_1 = \dfrac{0.52441 \times 0.96665}{0.52381} = 0.96776$

$$\tan \beta_1 = \frac{0.52381}{3 \times 3.1416} = 0.05558$$

$\beta_1 = 3° 10' 52''$

$$\cos \alpha_1 = \frac{0.96776}{0.99846} = 0.96925$$

$\alpha_1 = 14° 14' 40''$

When the hob is set at such an angle that the helix at any diameter of the hob is tangent to the teeth of the gear being cut, the width of the space of the gear at that point will be equal to the normal thickness of the hob tooth at that diameter. At all other diameters of the hob, the space cut in the gear blank will be wider than the normal thickness of the hob tooth.

As noted before, a change in the angular setting of a hob affects only the width of space and the fillet at the root of the gear tooth. Above the fillet, the involute profile will remain unchanged. If a hob were used to cut a rack, a change in its angular setting would also affect its pressure angle and circular pitch, but the change in one element would compensate for the change in the other so that both racks would have the same normal pitch.

The change in thickness of space is of secondary importance. The critical factor is the height of the fillet. Too high a fillet at the root of a gear tooth leads to edge contact at the beginning of mesh, a most serious fault. In many cases, interference on the fillet is responsible for

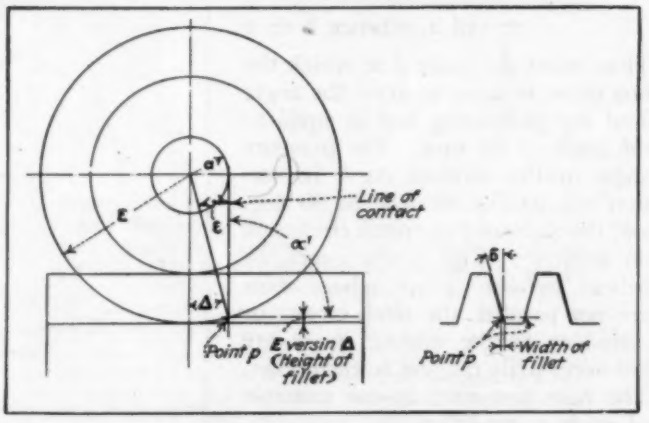


Fig. 49—Determination of fillet formed by hob set square with rack

noisy and troublesome gears. This height of fillet limits the amount of variation in the angular setting of a hob that can safely be used. We will therefore direct our attention to the fillets that result from various angular settings of a hob.

For the purpose of simplicity we will first consider the hob as generating a straight-sided rack. The fillet on a gear tooth will be greater in height than that on a rack, the amount depending largely upon the number of teeth in the gear. The smaller the number of teeth, the higher this fillet will be.

We will also first consider a hob with sharp corners at the tips of the hob teeth. The actual fillets produced would be larger, both in width and height, by an amount approximately equal to the radius of the fillet at the tip of the hob tooth.

We will consider first a hob set square with the face of a rack. Referring to Fig. 49, let

K = lead of hob
a = radius of base cylinder
E = radius to tip of hob tooth
δ = angle of generatrix of hob
Δ = angle of rotation of hob from vertical centerline to point of contact of point p
ε = angle between radial line to point p and line of contact

In this example, $\varepsilon = \Delta$ and $\sin \varepsilon = \frac{a}{E}$

The additional height of the fillet is equal to the distance from the root of the rack to point p. Whence,

Additional height of fillet = E versin Δ

The additional width of the fillet is equal to E versin Δ tan δ plus the amount the point p travels along its helix as it is revolved from the vertical centerline to the line of contact. This point revolves through the angle Δ, whence

$$\text{Additional width of fillet} = E \text{ versin } \Delta \tan \delta + \frac{\Delta K}{2\pi}$$

As a definite example, we will determine the additional height and width of the fillet produced on a rack by the hob used in the preceding example when set square with the face of the rack. This gives us the following values:

$K = 0.52381 = \frac{11}{21}$ in.
$E = 1.6667$ in.
$\cos \delta = 0.96776$
$\delta = 14° 35' 20''$

$$a = \frac{K}{2\pi \tan \delta} = \frac{11}{42 \times 3.1416 \times 0.26027} = 0.32031 \text{ in.}$$

$$\sin \varepsilon = \frac{a}{E} = \frac{0.32031}{1.6667} = 0.19218$$

$\varepsilon = \Delta = 11° 4' 50''$

Additional height of fillet = E versin Δ
$= 1.6667 \times 0.01865 = 0.0311$ in.

$$\text{Additional width of fillet} = E \text{ versin } \Delta \tan \delta + \frac{\Delta K}{2\pi}$$

$$= 1.6667 \times 0.01865 \times 0.26027 + \frac{0.19339 \times 11}{42 \times 3.1416}$$

$= 0.0242$ in.

If the hob had a fillet of 0.0333 in. at the tip of its tooth, the total fillet at the root of the hobbed rack would be as follows:

Height of fillet = 0.0333 + 0.0311 = 0.0644 in.
Width of fillet = 0.0333 + 0.0242 = 0.0575 in.

These values are slightly greater than the actual ones because the fillet at the corner of the hob tooth covers somewhat less than 90 deg. Any further refinement is not necessary, however.

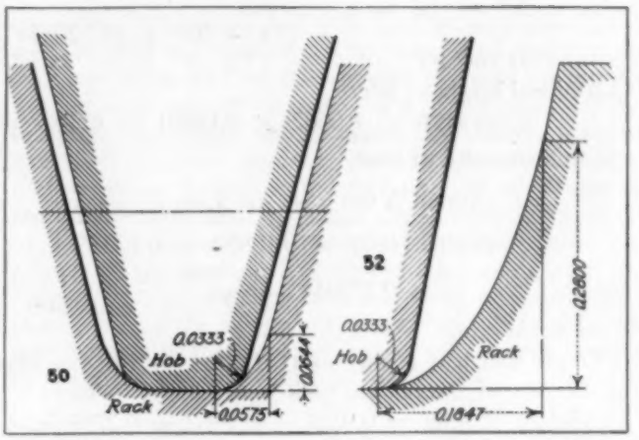


Fig. 50—Rack form developed by hob set square with it
Fig. 52—Rack form developed by hob set at an angle of 10 deg. to rack

In this case the hob will generate a rack with a pressure angle of 14° 35' 20". The circular pitch of this rack will be the same as the lead of the hob, or equal to 0.52381 in. In Fig. 50 this rack form is plotted.

We will now consider the hob when it is set at an angle to the rack, the angle being in the same direction as the helix angle of the hob. This would give us the conditions shown in Fig. 51. In this case let K, a, E, δ, Δ and ε remain as before and in addition let

α = pressure angle of hobbed rack
α' = angle of intersection of rack with plane perpendicular to axis of hob.
P = circular pitch of hobbed rack
β = angle at which hob is set.

Referring to the figure, we have

$$\sin \varepsilon = \frac{E}{a}, \quad \text{and} \quad \tan \alpha' = \frac{\tan \alpha}{\sin \beta}$$

$$\Delta = 90° - (\alpha' + \varepsilon)$$

Additional height of fillet = E versin Δ

$$\text{Additional width of fillet} = E \text{ (versin } \Delta \tan a + \sin \Delta \sin \beta) - \frac{\Delta' K}{2\pi \cos \beta}$$

As a definite example we will take the same hob as before and set it at an angle of 10 deg. in the same direction as the helix on the hob. This gives us the following values:

$K = 0.52381 = \frac{11}{21}$ in.
$E = 1.6667$ in.
$\delta = 14° 35' 20''$
$\beta = 10°$
$a = 0.32031$ in.

$$\cos \alpha = \frac{\cos \delta}{\cos \beta} = \frac{0.96776}{0.98481} = 0.98269$$

$\alpha = 10° 40' 30''$

$$P = K \cos \beta = \frac{11 \times 0.98481}{21} = 0.51585 \text{ in.}$$

$$\sin \varepsilon = \frac{a}{E} = \frac{0.32031}{1.6667} = 0.19218 \text{ in.}$$

$\varepsilon = 11° 4' 50''$

$$\tan \alpha' = \frac{\tan \alpha}{\sin \beta} = \frac{0.18850}{0.17365} = 1.08552$$

$\alpha' = 47° 20' 54''$

$$\Delta = 90° - (\alpha' + \varepsilon) = 90° - (11° 4' 50'' + 47° 20' 54'')$$
$$= 31° 34' 16''$$

Additional height of fillet

$$= E \text{ versin } \Delta = 1.6667 \times 0.14801 = 0.2467 \text{ in.}$$

Additional width of fillet

$$= E \text{ (versin } \Delta \tan a + \sin \Delta \sin \beta) - \frac{\Delta K}{2\pi \cos \beta}$$
$$= 1.6667(0.14801 \times 0.18850 + 0.52355 \times 0.17365) - \frac{0.55102 \times 11}{42 \times \pi \times 0.98481}$$
$$= 0.1514 \text{ in.}$$

If the hob had a fillet of 0.0333 at the tip, the fillet at the root of the hobbed rack would be as follows:

Height of fillet = 0.0333 + 0.2462 = 0.2795 in.
Width of fillet = 0.0333 + 0.1514 = 0.1847

In Fig. 52 this rack form is plotted.

This setting angle is so large that over half of the tooth profile of the hobbed rack would be in the fillet. In addition, the tooth would be thinner by an amount equal to about double the additional width of fillet, or about 0.3000 in. In this case, unless the tooth of the hob was very thin, there would be nothing but fillet for the rack tooth form. This setting angle is beyond the range of practical utility. If the hob were set at the helix angle at the outside diameter of the hob, there would be no sidecutting at that diameter of the hob and the fillet at the tip of the hob tooth would reproduce itself in the hobbed rack or gear. This is the setting angle for a hob where the fillet is reduced to a minimum.

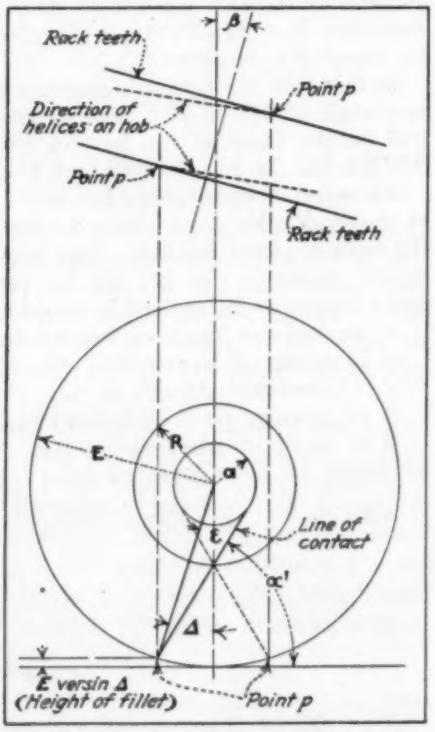


Fig. 51—Diagram of hob set at an angle to rack

We will now take this same hob and set it at an angle of 3° 11′, which is very close to its helix angle at the middle of the hob tooth, and calculate the height of the fillet on the hobbed rack under these conditions. This gives us the following values:

$$K = 0.52381 = \tfrac{11}{21} \text{ in.}$$
$$E = 1.6667 \text{ in.}$$
$$\delta = 14° 35' 20''$$
$$\beta = 3° 11'$$
$$a = 0.32031 \text{ in.}$$
$$\cos \alpha = \frac{\cos \delta}{\cos \beta} = \frac{0.96776}{0.99846} = 0.96925$$
$$\alpha = 14° 14' 40''$$
$$P = K \cos \beta = \frac{11 \times 0.99846}{21} = 0.5230 \text{ in.}$$

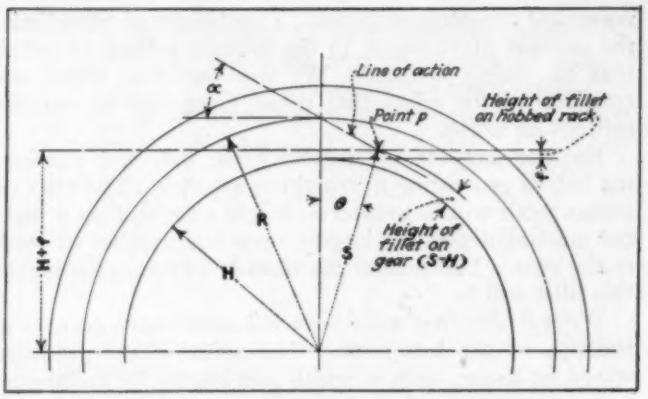


Fig. 53—Determination of fillet conditions at root of a hobbed gear

$$\sin \varepsilon = \frac{a}{E} = \frac{0.32031}{1.6667} = 0.19218$$
$$\varepsilon = 11° 4' 50''$$
$$\tan \alpha' = \frac{\tan \alpha}{\sin \beta} = \frac{0.25386}{0.05553} = 4.57158$$
$$\alpha' = 77° 39' 40''$$
$$\Delta = 90° - (\alpha' + \varepsilon) = 1° 15' 30''$$

Additional height of fillet = E versin Δ
$= 1.6667 \times 0.00024 = 0.0004$ in.

If the hob had a fillet of 0.0333 in. at the tip, the total height of the fillet at the root of the hobbed rack would be as follows:

Height of fillet = 0.0333 + 0.0004 = 0.0337 in.

The practical limit in the variation of the setting angle of this hob is about 3 deg. either side of the helix angle of the hob. More variation than this increases the height of the fillet to such an extent that there would be danger of fillet interference with the tip of the profile of the mating gear tooth. This limited amount of variation is enough, however, for all practical purposes.

We will now examine the fillet conditions at the root of a hobbed gear. Here we are concerned primarily with its height. Referring to Fig. 53, we have:

R = generating or pitch diameter when meshing with hobbed rack
H = root radius of gear
N = number of teeth in gear
α = pressure angle of hobbed rack
P = circular pitch of hobbed rack
f = height of fillet on hobbed rack
S = radius to top of fillet on hobbed gear
ϑ = angle between intersection of top of fillet with line of action and centerline of gear.

Solving this simple problem in trigonometry, we have:

$$\tan \vartheta = \frac{R - (H + f)}{(H + f) \tan \alpha}$$
$$S = \frac{H + f}{\cos \vartheta}$$

Height of fillet on gear = $S - H$.

As a definite example we will consider a 36-tooth gear hobbed with the 6-D.P. hob set square with the axis of the gear, which was used in a preceding example of a hobbed rack. From this preceding example we get the following values:

N = 36
H = 3.0000 — 0.2000 = 2.8000 in.
α = 14° 35′ 20″
P = 0.52381 = 11/21 in.
f = 0.0644 in.

$$\text{Whence } R = \frac{N \times P}{2\pi} = \frac{36 \times 11}{2 \times 21 \times 3.1416} = 3.0012 \text{ in.}$$

$$\tan \theta = \frac{3.0012 - (2.8000 + 0.0644)}{2.8644 \times 0.26027} = 0.18350$$

$$\theta = 10^\circ\ 23'\ 55''$$

$$S = \frac{2.8644}{0.98358} = 2.9122 \text{ in.}$$

Height of fillet on gear = 2.9122 — 2.8000 = 0.1122 in.

If this fillet is so high that it extends into the active profile of the gear, interference with the tip of the mating tooth profile will take place.

Locating Pilot Holes in Punches

By Atol Maker

THE method generally pursued in building a progressive piercing and blanking die is to make a templet containing the various holes to be pierced in the blank, and to use it to locate the piercing holes in the die plate and the several pilot holes in the blanking punch. When the templet is used for locating the pilot holes in the punch, it is inserted in the die opening along with the punch, and the holes are spotted.

Whenever I find it advisable, I build the die without the conventional templet, because it takes considerable time to make an accurate templet and it also takes much time and patience to file out a die to fit it. When a die is built without a templet, the method pursued for locating the pilot holes depends largely upon the form of the blanking punch and the die opening, and the position of the pilot holes in relation to the same.

The form of the opening in the die shown in Fig. 1, and the position of this opening in relation to the sides of the die plate, made it advisable to use a height gage as a means of locating the pilot holes. It will be noticed that the die opening consists of straight sides and circular forms, and that the various straight sides are parallel to the sides of the die plate. The centers of all the piercing holes, the centers of all the circular portions of the die opening, and the straight sides were laid off by a height gage. All the circular portions of the die opening were easily bored to size in a lathe, and the straight sides were easily machined to the desired degree of accuracy in a shaper. Dimension *A* was determined when laying off the plate with the height gage. When machining the straight sides of the die opening, I measured dimension *A* with the micrometer. The other straight portions of the die opening were measured in a similar manner. In the punch and die shown in Fig. 2, it was essential that the various piercing holes be located accurately. The form of the die opening was not so important, since it consisted of straight sides and circular portion. I decided that it could be easily machined to a finish in the lathe and shaper, and that a templet was not needed. The centers of the various piercing holes, and of the circular portions of the die opening were laid off by means of a height gage, and the openings were bored in the lathe. Particular care was exercised to obtain accuracy in locating the holes *B* in the die plate. Owing to the fact that the pilot holes in the punch were laid off from the circular portions *B* of the die opening, it was essential that the relative positions of all these points should be correct. If the amount of error existing in the location of these points should exceed the amount of clearance between the pilot and the hole in the blank where the pilot enters, trouble in operating the die would be sure to result.

In Fig. 3 is shown the method of locating the pilot holes in the punch. The die opening was made slightly tapered and the bushings *A* and *B* were made to fit it. These bushings were held securely in place during the spotting, drilling and reaming of the punch, by means of the wedge *C*. The parallel blocks *D* and *E* were about ⅛ in. shorter than the punch, allowing the punch to enter about ⅛ in. into the die opening. Very little time was consumed in making the wedge *C* and the two bushings. By employing this method, very good results were obtained.

Another method was employed for drilling the pilot holes when making the punch and die shown in Fig. 4. In this case bushings were made to fit each side of the punch, each bushing having a hole through one end to fit the drill which was to be used for the pilot hole. The bushings were cut away so as to allow them to be placed on the punch, and were held in position by a small clamp. The holes were then spotted as shown. The spotting was done before the piercing punches were inserted in the punch plate, because some of the punches would have interferred with the parallel clamp used to hold the bushings in place. When making the die plate, the circular portions of the opening were laid off and were bored in

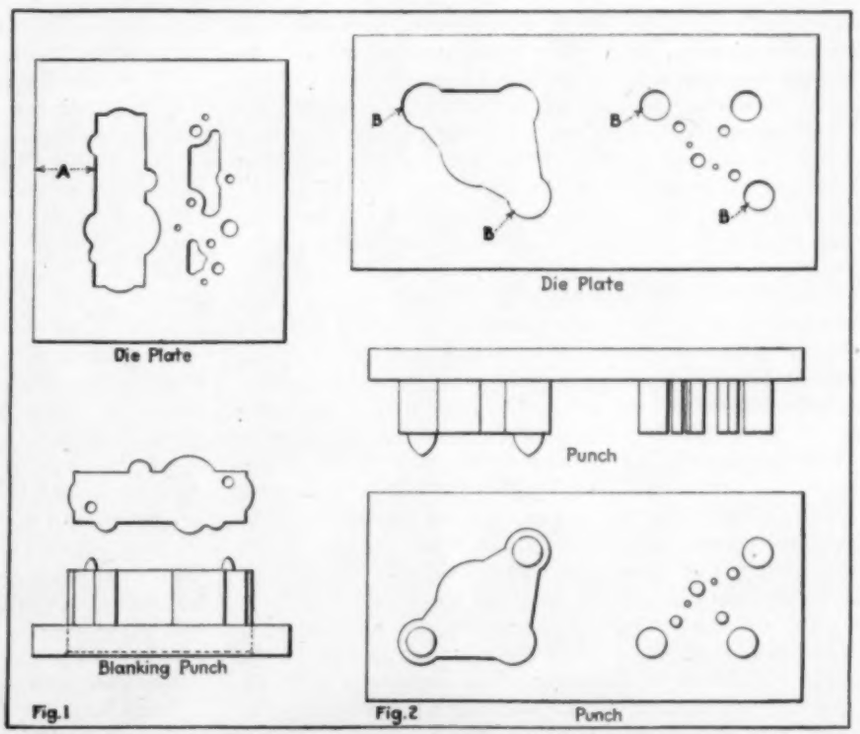
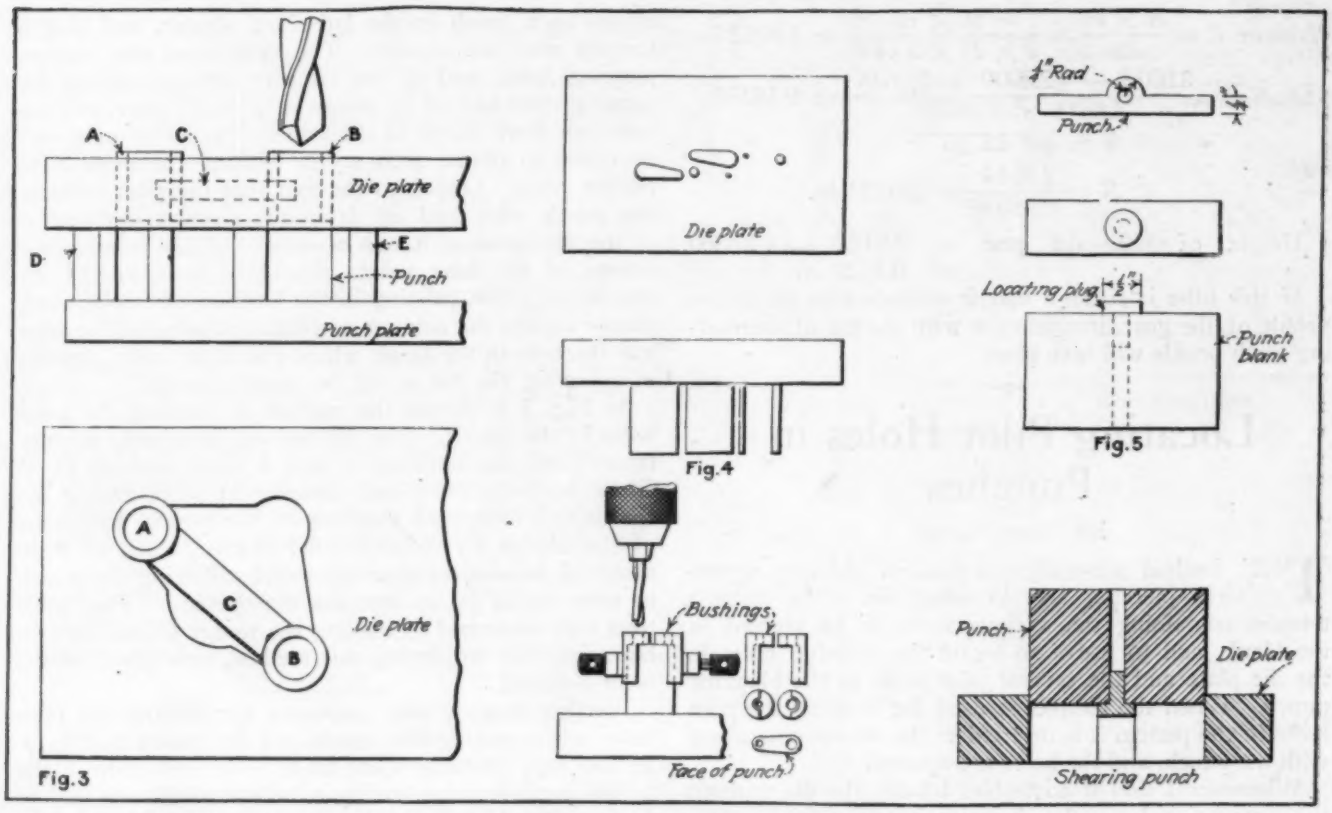


Fig. 1—The pilot holes in the punches were located by a height gage.
Fig. 2—The pilot holes in the punch were laid off from the die opening



Figs. 3 and 4—The pilot holes in the punches were drilled through bushings. Fig. 5—The pilot hole in the punch was located from the piercing hole in the die plate

the lathe along with the piercing holes, thus when the bushings were slipped over the circular sides of the punch, the holes in the bushings would be in the proper place for the accurate spotting and drilling of the pilot holes.

Still another method was used when making the punch illustrated in Fig. 5. In this case, accuracy was not required in the blank, but it was essential that the pilot hole in the punch be in the proper position relative to the one piercing hole in the die plate. When making the die plate, the one piercing hole and the circular portion of the die opening were laid off and bored in proper relation to each other, thus if the pilot hole were located exactly in the center of the circular portion of the punch, it would be in the correct position. This same rule holds good in the preceding cases described in connection with Figs. 3 and 4. When making the punch, the pilot hole was drilled through the punch blank first, and then the punch was worked up around the pilot hole. There being only one pilot hole, this was a simple matter. The locating plug shown was turned to fit the pilot hole in both the punch and the circular portion of the die opening. I have not shown a plan view of the die because it can be pictured by looking at the plan view of the punch.

When the punch blank was laid on the die plate so that the locating plug fit into the circular portion of the die opening, the form was marked off on the face of the punch blank. Besides locating the punch blank for marking off the outline of the punch, the locating plug served as a gage when filing the circular portion of the punch. Finally, the locating plug served to properly locate the punch over the die opening while shearing the punch. By making the punch in the manner described, it was almost impossible to get the pilot hole in the wrong place.

Is Any Work Of Itself a Cause of Degeneration?—Discussion

By George F. Johnson

IN THE *American Machinist*, Vol. 66, page 963, W. O. Platt has an article under the above title which found a responsive chord in me. And yet, in spite of the fact that I agreed with the sentiment that lies behind his obviously honest indignation, nevertheless I could not help but feel that his "vaulting indignation o'erleapt itself" and landed him in a very undesirable conclusion.

That mythical cornsheller plant where "every man did that which was right in his own eyes" was not a democracy. In fact, I thought it was as nice an example of anarchy as one could hope to find. It was absolutely headless, a feature that differentiates it from a democracy. That they produced any kind of a contrivance that did useful work was remarkable.

Democracy and executive are not mutually exclusive terms. The chief executive can be called any kind of a name, including "The Big Boss," without being anomalous to democracy. Also the "Big Boss" may issue orders which may be just as final and arbitrary as anything any dictator ever got away with. Still, that does not make him an autocrat no matter how cantankerous he may appear. There is a power behind him that is fully capable of supplanting him when he does not earn his salary. With an autocrat, the replacement would not be so easy, although one is inclined to think that competition might even take care of that if a real dyed-in-the-wool divine-right autocrat should appear.

Therefore, for my own satisfaction I have substituted the terms "arbitrator" and "chief executive" in place of "autocrat" in Mr. Platt's article, and find I am then not so emotionally decimated.

Odd Jobs in a big shop

Photographs by courtesy of the Worthington Pump and Machinery Corporation.

Fig. 1—Boring and counterboring a large air compressor casting on a revolving fixture

Fig. 2—Rotary boring fixture mounted on a truck. A horizontal air cylinder moves the truck out for loading

Fig. 3—Surfacing a large plate with two end mills, on a special machine

Operations in Making Electric Meters

Photographs by courtesy of the Sangamo Electric Co., Springfield, Ill.

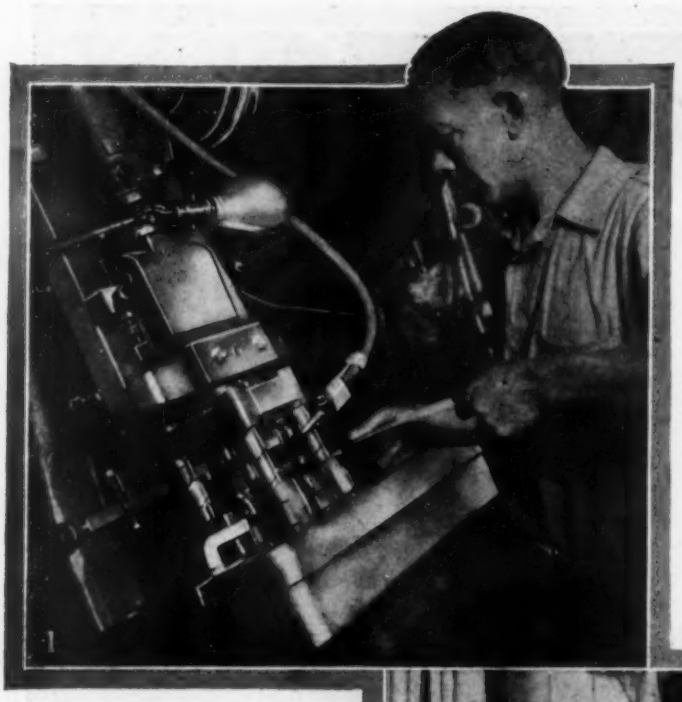


Fig. 1—A combination punch-press operation that performs four operations on levers. It blanks, punches, bends, closes the bends and finally cuts off. Each stroke of the press gives two complete levers. Air jets are used for blowing the work clear of the dies

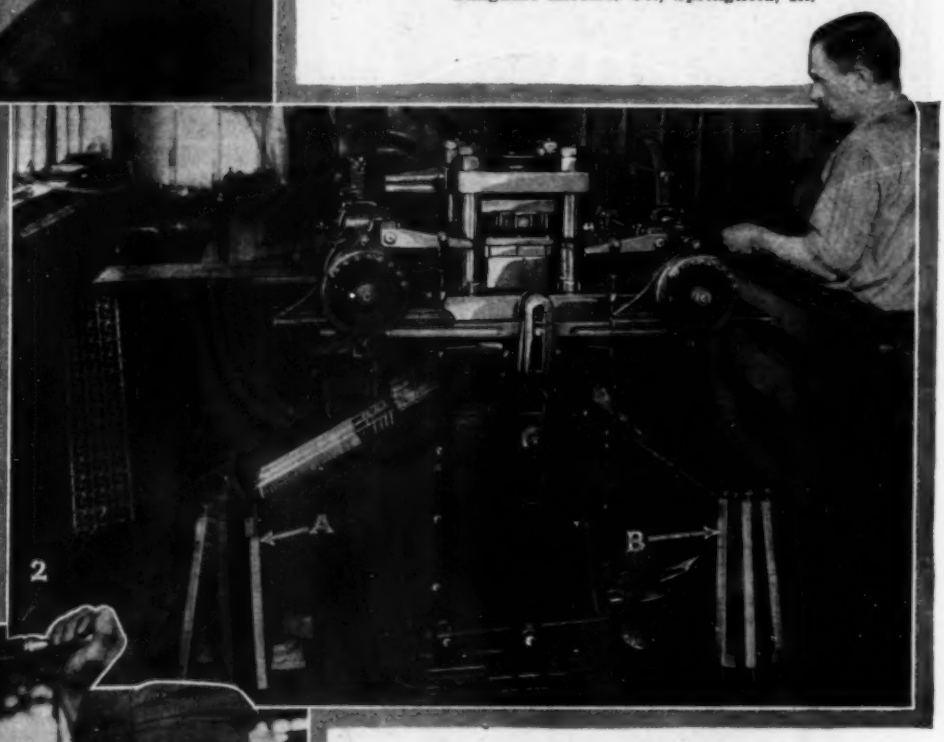


Fig. 2—Dieing machine that punches six pieces across the width of the strip, as can be seen at the left. Delivery racks are provided on each side, as at *A* and *B*, where they slide onto rods

Fig. 3—Multiple drilling head for the holes in the meter cases. The drilling head is in a complete unit by itself, the whole head being guided by suitable pillars so as to insure accurate location of the holes

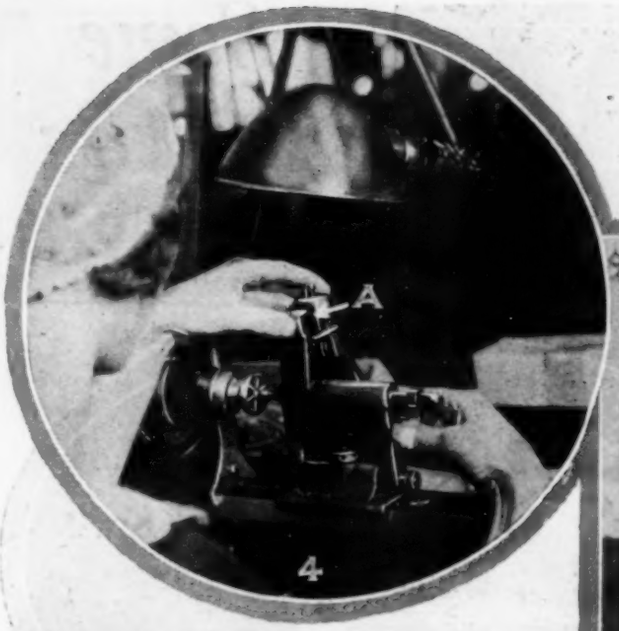


Fig. 4—Boring holes in a gear to fit its shaft properly. The shaft is placed in position as at *A* and the shaft diameter determines the amount the cutting tool is set off center so that it will bore each hole to the correct size

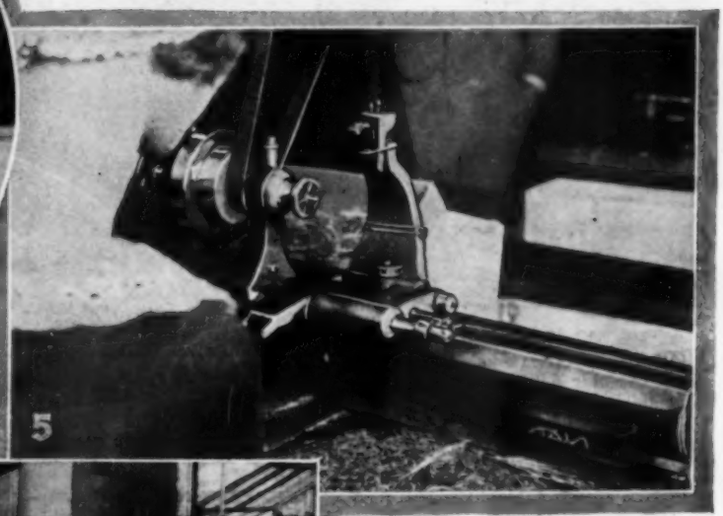


Fig. 5—This view shows the shaft in its gear after the boring tool has been swung down out of the way. It shows the gaging point at the top which forms one side of the caliper in determining the offset of the boring tool to secure the correct hole diameter

Fig. 6—Inspecting bearing jewels under binocular microscopes after they have been mounted in their regular settings. This inspection determines whether the jewels have been cracked or even distorted while being mounted

Fig. 7—Removing dust from meter parts by air jets. Exhaust heads take the dust out of the room instead of circulating it. The cover is put in place immediately to exclude dust

Some Details of Stoker Gearing

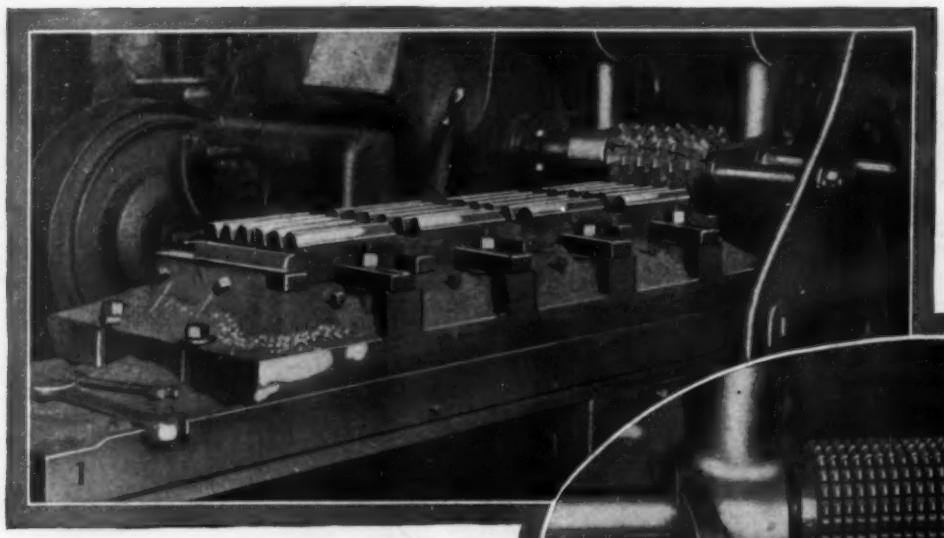
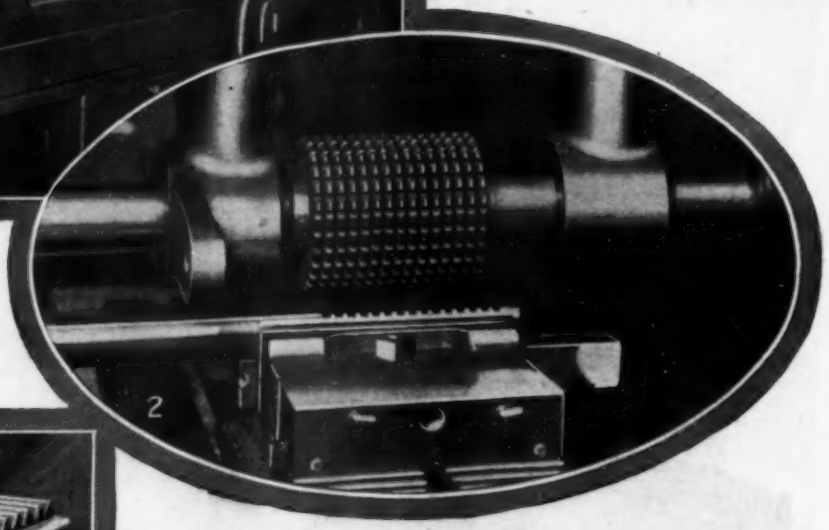


Fig. 1 — The roughing cut on the stoker racks. Each rack contains 6 teeth and the fixture allows four racks to be cut at each setting. The use of the rack is seen in Fig. 4



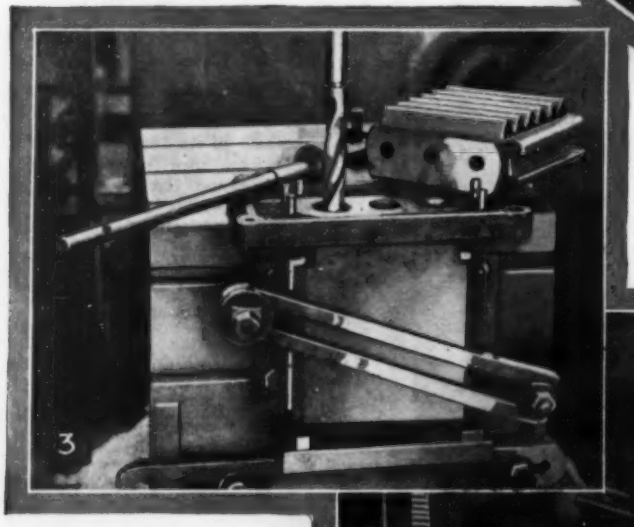


Fig. 2—Cutting rack teeth on a pusher bar, with bar held in vise. The bar is actuated by one rack as in Fig. 4

Fig. 3—Drilling the racks for pusher bar and rods. The fixture is simple, using a hairpin clamp across the front

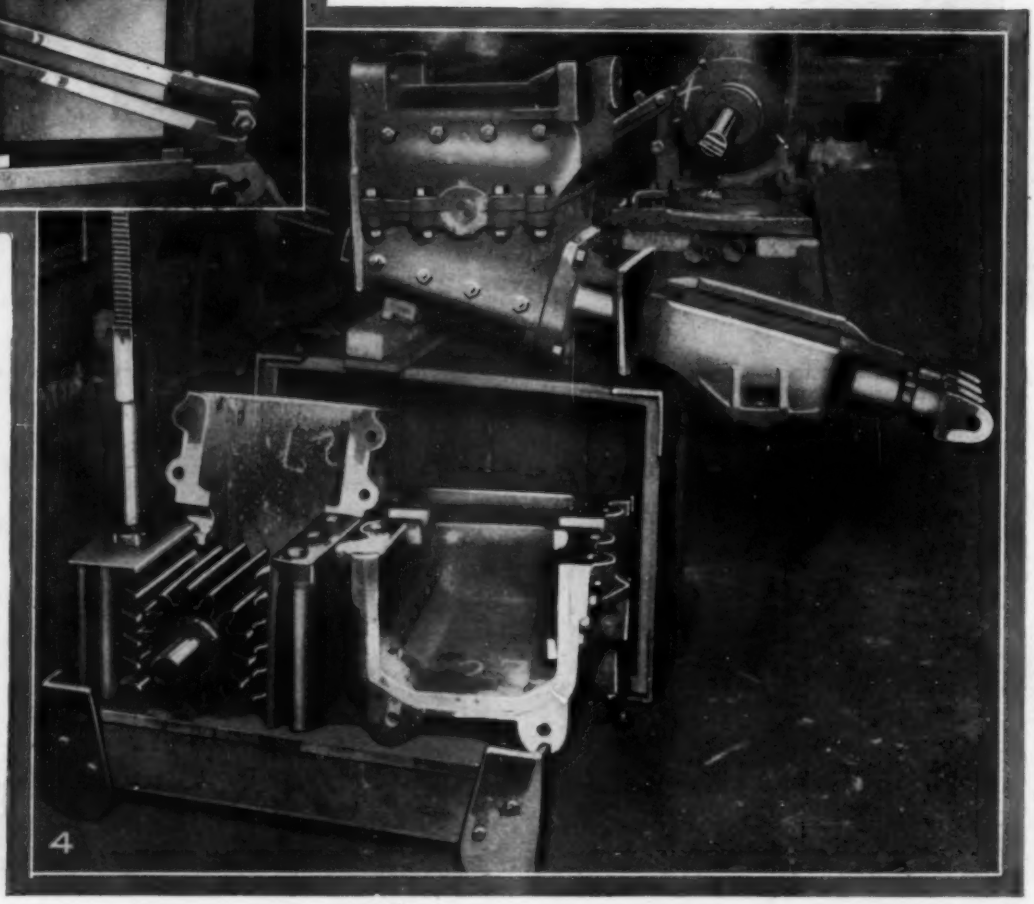


Fig. 4 — An assembled pusher bar and the parts that go on it. This shows how the racks are actuated by the central pinion

Material Handling System in a Railroad Shop

Instead of allowing workmen to get their own materials, requisitions are handled by dispatchers, and materials are delivered by the stores department

IN MANY railroad shops it is not unusual to see several men chasing stock, as it is most generally termed, so that an actual cost-recording system of material handling is next to impossible. Men will invariably congregate for a little chat at the stores-department counter, where general supplies are issued, or meet somewhere within the yard on the way back and forth from the shop to talk about the topics of the day, if most anyone is allowed to obtain his own stock.

At the Union Pacific shops, Omaha, Neb., transportation, in its broad sense, is considered basic to shop operation. Increasing the efficiency of material handling receives the attention of executives, because whatever devices or methods can be used to do the work of men, will relieve more men for other jobs, thus aiding in the reduction of repair costs. Transportation at these shops is considered from three angles: to eliminate hand labor as far as possible; to permit the economical moving of material from one place to another; and to increase the amount of work turned out by avoiding delays.

The material-handling system in use is not complicated. Materials are divided into two classes, small parts and heavy units. The smaller parts are kept in a storehouse, approximately 50x200 ft., including a loading platform. This building is located close to the machine, boiler, forge, and erecting shops and is the headquarters for the stores department. As shown in Figs. 1 and 2, it is divided into sections for the storing of supplies. Each section is numbered, and the shelves of each section are labeled to correspond with the materials placed on them. Heavy units are stored in the yard at one end of the erecting shop.

Throughout the various departments of the shops are located order boxes, each of which is given a station number. A foreman requiring material makes out an order bearing the specifications of the material desired

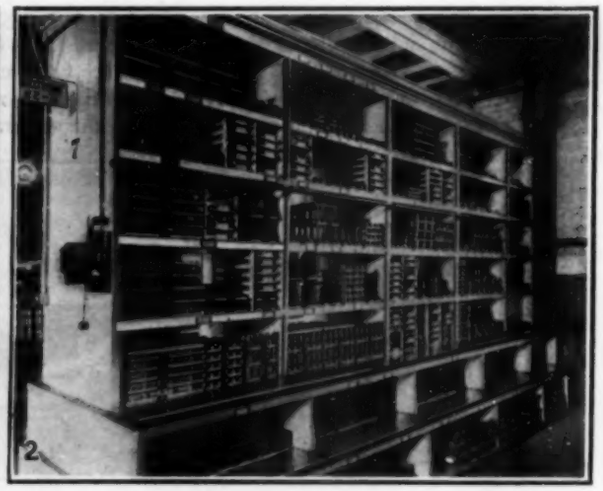


Fig. 1—Interior view of the stores department. Fig. 2—One of the sections of the stores department

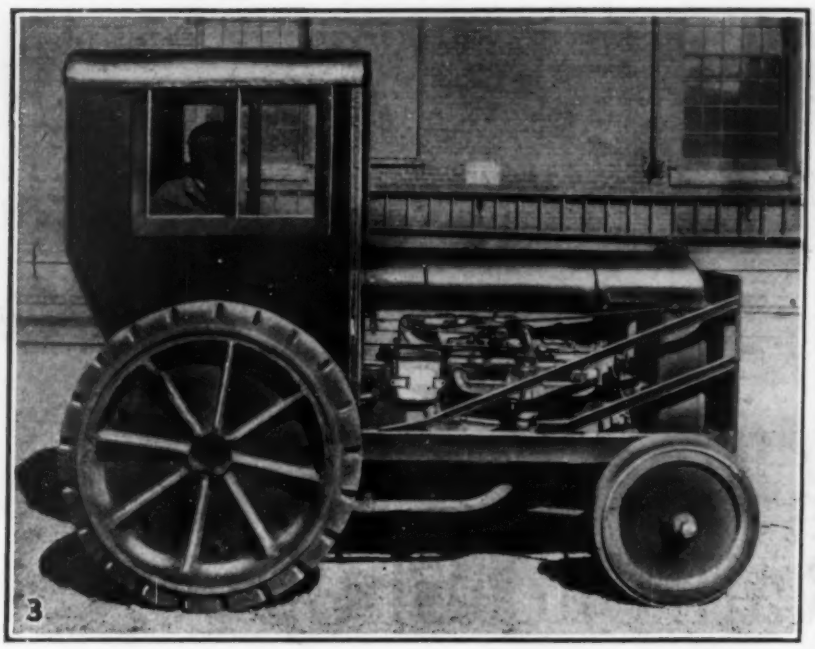


Fig. 3—Tractor provided with a cab and armor plate.

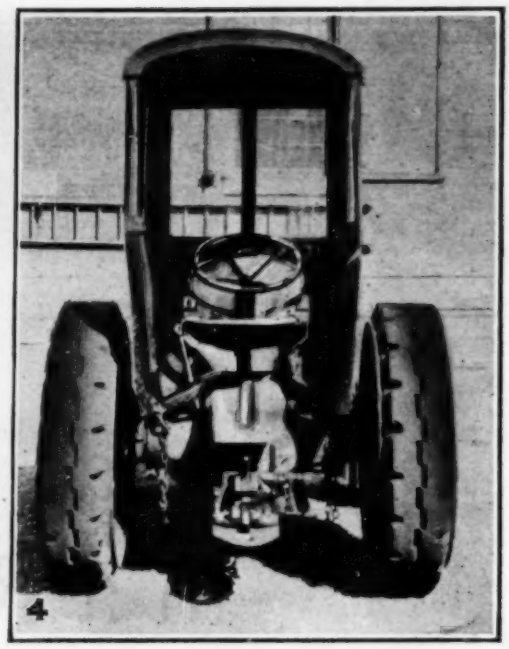


Fig. 4—Rear view of the tractor showing the coupling

and the station number to which it is to be delivered. The order is collected by a shop messenger, whose duty it is to make frequent trips throughout the shops and to deliver the order to the superintendent's office. Then, after the order has been checked for accuracy, a materials request order is made out, which is likewise collected by the messenger during one of his trips, and delivered to the stores department.

If the order requests material of the smaller class, such as general supplies, the material is collected by a shop counter-man, placed in a box, tagged with the station number from which the order was issued, and then delivered to its destination. Hand trucks of the push-cart type are used by the stores department to deliver light loads, for which transportation delivery men, under the jurisdiction of the stores department, are employed.

Several tractors and trailers are used for the transportation of heavy parts. The operators of the tractors receive their orders from the stores department, and after completing a trip return for further duties. In this way it is possible at all times to determine the approximate location of a tractor, and when it can be expected to return. Orders for heavy units to be picked up from the yard storage are delivered to the operator of a tractor, who collects the material and delivers it to the station from which it was ordered. The collection of these materials, however, is arranged so that during one trip a tractor can gather several orders and make deliveries to the various departments as planned by the dispatcher. The tractor operator usually has a helper with him, so that with the help of the yard storekeeper, materials can be collected and loaded easily.

To fill in time between trips, the tractors are kept occupied with miscellaneous inter-departmental work and various duties in connection with locomotive repair. In the machine and erecting shops a dispatcher is in charge of material handling, and all orders for the transportation of parts are issued to him. The work comprises chiefly the removing of parts from the stripping pits to various departments of the machine shop, and delivering finished parts to the erecting pits. Two tractors are kept busy practically the entire time on this class of work.

One of the tractors used for material handling is illustrated in Figs. 3 and 4. It has a cab around the driver's seat for protection against bad weather, and on the front end is mounted a steel plate, supported by braces to the chassis frame, so that the tractor can be used to push trailers short distances. A coupler at the rear end of each tractor is so arranged that trailers can be attached by the tractor operator without the necessity of leaving his seat. The headpiece shows a series of trailers connected to a tractor delivering miscellaneous interdepartmental material.

In Figs. 5 and 6, one of the smaller Hesse trailers used in connection with material handling, is illustrated. Both axles of the trailer are attached to swivel plates so

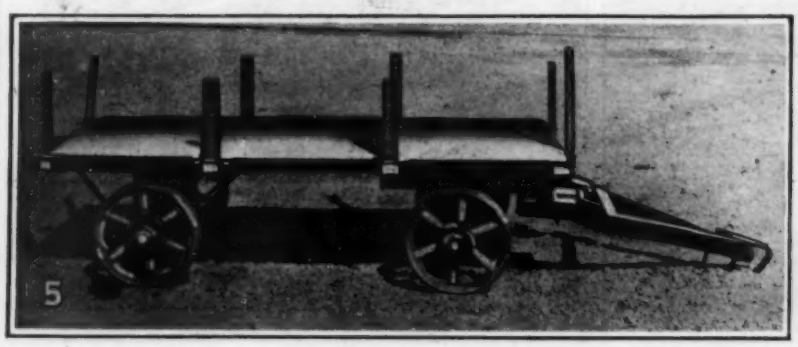


Fig. 5—One of the smaller trailers used in connection with material handling.

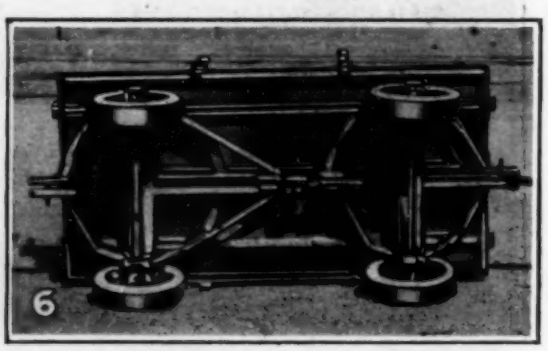


Fig. 6—Bottom view of the trailer

that they work in unison when the handle or connecting arm is swung in either direction. This feature insures, to a certain extent, having the trailers follow the path of the tractor, thus eliminating confusion when several trailers are being hauled through a narrow passage, or upon entering a doorway where there is a turn to be made.

With this system of material handling, there is less confusion than existed formerly, and rarely are there any delays in the delivery of material to desired locations at a specified time.

Is Works Harmony Possible?

By C. B. Gordon-Sale
England

WORKS organization is a subject on which we all have been either talking, writing or reading for several years. We are told that it is becoming increasingly important and that quite a large part of the success of American industry is due to efficient works organization. Excellent as some of the schemes undoubtedly are, they miss a point which I have always found of the very highest importance. They ignore what for want of a better term I call "cussedness"—which pertains to all parties connected with production from the manager down to the shop boy. The views I am about to express may read like heresy to some readers, but in defense I can only say that I shall endeavor to write that which I know to be strictly true.

Take the case of "line organization" which is common to most British factories. The various branches such as manufacture, planning and maintenance start from the general manager, run via his lieutenants down to the men in the shops and the technical staff and progress clerks in the office. The "family tree" of a large concern is a most complex affair. There are several other methods of organization, but the line style is the most popular because it has the reputation of making for better discipline in the various departments.

That it does so in each section considered separately there is no question. Trouble arises when the relationships between the different sections are considered. Suppose for instance the planning section says that a job must be done in a certain manner which is against the opinion of the foreman, who refuses to proceed according to the layout sheet. Before pressure can be brought to bear upon him the whole system of the line has to be gone through right up to the general manager and then down from him to the foreman. In the process the facts of the case will have been warped to such an extent that the rights and wrongs are all at variance. A conclusion may be arrived at and a ruling given which is unjust.

Let me quote a frequent source of trouble which is never mentioned in the line organization. Most firms have no such thing as an experimental production shop. Such a thing is valuable but costs a lot of money not justified by the usual run of output. Nevertheless, samples of contemplated productions have to be made up. Members of the technical staff handle the question and have to hawk the parts about the shops, more or less begging the foremen to get on with them. It is to be hoped that it is not thought I am aiming my criticisms at foremen in particular; they are only one of the snags that prevent harmony in the works. Naturally, a man does not want to hold up his schedules for the sake of a few special parts, but at the same time he need not delay the job more than is absolutely necessary.

Of course the discord existing between the shops and the office is one which started as soon as a staff became necessary. The men who do the work seem to think that they are the only ones of consequence, regarding the others as "paper merchants" as I have heard expressed. There is a certain amount of justification in the attitude, for so many of the staff assume a superiority of manner presumably because they are able by virtue of their positions to keep both their hands and their collars clean. Also, it is well known that it is far easier to make a mistake on a sheet of paper than to fall into error on the actual job. The men in the shops are quick to note faults in their instructions, as the caustic comments well illustrate.

Another source of trouble is between the shops and the inspection department. There is much to be said on both sides. There are two ways of looking over a component even when a set of gages have to be used. One may be lenient or the reverse. People belonging to the inspection departments often fall into the error of thinking that it is their duty to reject as many parts as possible. Actually they should pass as many as possible so long as the quality of the resultant product does not suffer thereby. There is usually a continual struggle between the manufacturing departments and the inspection people.

Between the different departments there is usually sleeping strife. If the foreman of the automatic screw machines does not like the foreman of the drilling section he will never trouble himself to get work intended for the former away at the earliest moment. There is no need for a definite refusal; it is just a case of not pushing things on.

Harking back to the office we find that the draftsman who designs the tools and fixtures rarely has a chance to see the machine upon which they are expected to work, let alone see them after they are in use. It seems absurd but the condition exists in most works and arises through the foremen not liking to have a crowd of office men hanging around.

It can well be believed that efficient organization works miracles, for I have yet to see a factory of any size which possesses a system which works even fairly satisfactory. Most of those with which I have been in contact have been disgraceful, and chiefly because they simply ignored the fact that the persons were human beings and not mere automatons. The great thing to be striven for is harmony between the different departments. If everyone connected with manufacture would bear in mind that personal likes and dislikes should not enter into business things would be much better. Unfortunately we are all blessed with "cussedness" and so harmony cannot be attained. One of the best ways I have seen of clearing away some of the petty troubles is to have round-table conferences between the heads of the departments. Difficulties may be discussed and flow of work tends to be better because the real source of the irritating little hold-ups will not stand the light of public appreciation; hence they will be modified.

THE · FOREMAN'S · ROUND · TABLE

Saving Money with a New Machine

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"THIS foreman business isn't what it used to be, Al!"

"Now what's wrong, Ed?"

"My old friend Joe Meeker dropped in last night, Al, and told me of a new stunt his super pulled last week!"

"What was that, Ed?"

"Well, they've just put in a new boring mill, Al. A dandy, Joe says—and it cost ten thousand dollars. But instead of letting it go at that, the super plasters a notice in the boring machine department that tells all about what it cost, and what it's got to do to pay for itself."

"Just how do you mean, Ed?"

"Joe says the sign read something like this:

'This boring machine cost $10,000. The interest on $10,000 is $600 a year. Depreciation is $2,000 a year, a total of $2,600, or about $1 every working hour. This means this new machine must save at least $1 an hour to pay for itself. Can we make it?' "

"That's what I call laying the cards on the table, Ed. Gives you something to think about. Makes you wonder how you're going to save that dollar an hour."

"Makes you think too darn much, Al. How do they get that dollar-an-hour stuff?"

"Counts a fifty-hour week for fifty-two weeks, I guess, Ed. That's twenty-six hundred hours a year."

"But how can any machine save a dollar an hour, Al?"

"Some save a lot more than that, Ed. Saves not only labor cost, but takes less floor space for the work turned out. Saves time in assembling because the work is more accurate and goes together better. Saves spoiled work, perhaps, and saves time by speeding up other operations to match. One fast machine in a bunch often speeds up the men on the others without anyone saying much."

"You seem to like the idea, Al. Can't say as I do. Don't we have worries enough without throwing dollar signs at us?"

"Ed, my boy, if you ever want a job higher up you've got to know a lot about dollar signs. That's one reason the super gets more in his pay envelope than we do."

Is Ed wise in objecting to learning about machine costs and earnings? Or is Al right in feeling that it's a good plan to post costs where all can see them? Did Al name all the ways in which a new machine may save toward that dollar-an-hour total?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Abolishing Private "Mikes"

A STANDARD is the basis of all high-class production; if that standard is held high, less friction will arise in the way of interfering parts. Every measuring instrument should be under the direct control of the manufacturer, regardless of the question as to who should be the buyer. It is to his interest that there are no conflicting standards. The furnishing of micrometers, the inch size being the chief question at the moment, depends upon the value the manufacturer places in the standard. If he sees the value of a high-grade standard as beneficial to his interests in its effect upon production and interchangeability, he may consider the purchase a good investment. It is a question entirely with the manufacturer to decide whether he should go to the expense of such an investment. If he takes pride in his production, and aims to maintain strict basic standards, he should have the controlling say as to the use and upkeep of the tools. Almost every mechanic takes pride, assumably, in his 1-in. "mike," and takes pride in its care; he does not begrudge the expense of its purchase. But whether the employer or employee is the owner of the micrometers, they should be submitted for inspection. No new man should start to work before his micrometers are checked for accuracy. It is also commonly understood that no lending and borrowing of micrometers should be encouraged. This checking should be done periodically, and micrometers should be put through a cleaning and oiling at the time of the check. A micrometer that has been dropped should be submitted to the inspector before any measurements are taken with it. The ownership of the instruments should have no effect on the checking.

—JOHN HOMEWOOD.

THE : NEXT : TOPIC

Tool Sales in the Shop

QUESTION

If skilled mechanics take pride in their tools and insist on owning them themselves should they be able to buy them from the company?

Should the Shop Govern Purchases?

THE chief consideration is that the finished article shall be of the required standard of quality in material and finish, and the raw material purchased should be such that the finished article can be produced at the least cost, whether the actual cost of the raw material is the lowest possible or not. The sales department and the shop are the best judges of these factors.

The seller does charge for technical advice. He may call it advertising expense and put it in as overhead, but it has to be paid for and it goes on to the price of the goods supplied. This looks as though the one who buys the most goods pays the most for technical service, even though less service is required, but this is not necessarily so as the bulk purchaser usually receives a discount. It certainly would appear to be fair that a company supplying technical advice and solving a difficulty should get the business for a period in order to recompense them for expense incurred in the investigation.

—A. F. GUYLER, *England.*

Should the Foreman Get a Bonus?

IN MACHINE shops where bonus is calculated on output, the bonus percentage applying equally to the foremen and workmen, there is a noticeable outburst of activity at certain periods of the month, when the output figures are due to pass the scrutiny of the management. Work which may be more urgently wanted, but which is not so well advanced as other work, is neglected, and attention is concentrated upon the completion of that which is the most nearly finished, in order that its value may appear in the foreman's monthly output bonus. Long before the opening of the month, some foremen begin to select work that will in probability be completed before the end of the month, and that which stands little chance of completion is weeded out. While this method of payment to foremen may achieve its immediate object, it often has a marked effect upon the total production of the works. Another influence of a bonus to a foreman based on output alone lies in the scrapping of material. If a foreman has a casting in his shop which is not as satisfactory as it might be, but which could be used if it were attended to during the machining process, there is a strong tendency for him to reject it and select another casting which can be more quickly machined, and thus help to swell his bonus. All bonus schemes for foremen in my opinion should be based upon profit and not solely upon increased production.

—E. ANDREWS, *England.*

Looking Beyond the Department

I HAD the pleasure just recently of witnessing what looked to me like a strange sight. The foreman of the machine shop leaning back in his swivel chair, browsing, or some other mental sojourn, emitting from his puckered lips slow moving columns of smoke. Now, would you consider a sight like that good for sore eyes?

After a foreman has shouldered the burdens of the shop for several hours he invariably becomes abnormal; that is, he becomes charged with a higher potential than is good for his well being. Even a cat with a litter of kittens will desert them so that she may acquire a few moments of solitude. Put a good strong door on the

foreman's sanctorum; frosted glass if need be. Let him have his pipe or cigar, and he will emerge therefrom in ebulient spirits and better able to visualize broadly and meet emergencies as they arise. —JOHN HOMEWOOD.

THE practice of "the howling failure and silent success" policy leads to small assets on the positive side. It tends to focus the faculties of the men on the avoidance of the howling failure, to the complete neglect of the achievement of the silent success. "Nothing ventured, nothing won"; but what motive is there for men to venture when working under a policy that credits them nothing when they win, and discredits them if they lose? Experiment is the price of progress and the foundation of science, and any policy that discourages it, is unprogressive. —JOHN WOFFINGTON.

IF A foreman expects the management to look beyond the actual job and to consider him for promotion to positions of more importance, he must himself look beyond the little notch he is occupying to things that are sometimes far away from his own department.

The foremen who get promotion are the ones who watch the expenses in their own department, who go out of their way to see that all machines and men are kept busy, and who make themselves acquainted with the policies of the company in its relation to the employees and to advertising and sales. The foreman who expects promotion, must show that he is out for promotion by showing that he is interested in every phase of the company's work, though not before he is sure that his department is as efficient as possible.

—C. G. WILLIAMS.

Is the Company Picnic a Good Thing?

ED LOOKS at this matter from a selfish and personal standpoint. Look at the friendships that are invariably made at these outings. Away from the stress of the factory one gets a new angle on the bosses and on one's fellows, finding that they are not the hard boiled chaps we imagined them to be, but that most of them are real good sports.

Most English firms now have a welfare supervisor who arranges picnics and other social functions. He suggests a date, suitable places for the outing, gets all particulars as to cost, and publishes it on the bulletin board. A vote is then taken to find out the most popular place. There is no compulsion. All these social get-togethers I have attended have been great successes.

—T. WELSH, *England.*

I BELIEVE the company picnic can be a good thing, if carried out with the main idea of improving mutual understanding between management and men. The management of any concern whose whole dealings are solely work, with no thought whatever of the social side of life for their employees, is on the path to doom. The decision on whether or not there is to be a picnic should be decided by the employees themselves, and should receive the sanction of the management, who in turn should help them with the finance. The loss incurred in not running the factory on this day will be more than repaid by the goodwill of the happy and contented staff.

C. L. HENRY, *England.*

Applying the Budget to Small Tools

THERE is nothing to be gained by limiting the supply of small tools for any particular job. It is true that where limiting or a shortage of small tools are unavoidable, there will be often more time wasted by making shift with other than the right ones. A good plan is to issue a monthly sheet listing all of the stores supplied to each department, also the labor cost on tools supplied by other departments. Such a system does not limit production, because the foreman can have what he wants, and at the same time he knows exactly where he stands.

—H. MAPLETHORPE, *England.*

Hiring Back the Fired Workman

ONLY a foreman of Al's sterling qualities could be trusted to hire back even a chastened Grogan. But given such a craftsman in such circumstances and such a born leader of men, the venture is well worth the risk. To be down is not always to be out. The philanthropy and sentiment of the helping hand is often good business, and on occasion quite big business. If there is one graver defect, on purely business grounds, than glaring credulity it is uncompromising suspicion. The human touch in business can be, and often is, a splendid thing, and it frequently pays. —W. ROLAND NEEDHAM, *England.*

Keeping Down the Work in Process

EFFICIENT and well balanced machine tools so arranged as to reduce follow-up between successive operations to a minimum, together with efficient planning, stores assignment and forwarding, will go a long way towards helping to keep down work in process.

Evidently an excessive stock of finished or semi-finished stock ties up capital, and may involve loss by spoilage or by becoming obsolete. On the other hand, it is not usually economical to make expensive "set-ups" for small quantities of product. Clearly then, there is some medium course which will not involve an excessive amount of stock, will give an adequate supply for sales demands, and will not incur unnecessarily expensive operating costs. It may be, and often is, expedient to manufacture in lots that will much more than cover current requirements. —T. PILKINGTON, *Canada.*

Getting New Blood in the Shop

IF IT is necessary to bring in a new foreman from outside it is a serious reflection upon the management. It indicates that the policy does not bring out the best in the personnel. The theory that you get new ideas thereby is limited; the new foreman soon exhausts his stock, he is expensive until he has settled down. As for new ideas, what's wrong with a constant perusal of the technical journals? These give a far greater range of ideas than any foreman can offer. And think of the actual cash loss to a firm in refusing to promote the men! Trained, perhaps for years, in the peculiar methods and necessities of his shop or factory the good man has to seek elsewhere if he wants advancement. If a shop gets "rutty" it is lots to blanks that the management is nodding, and it is there that a little hoeing and weeding should be done.

—JAS. E. JOHNSON, *Inspector, England.*

Ideas from Practical Men

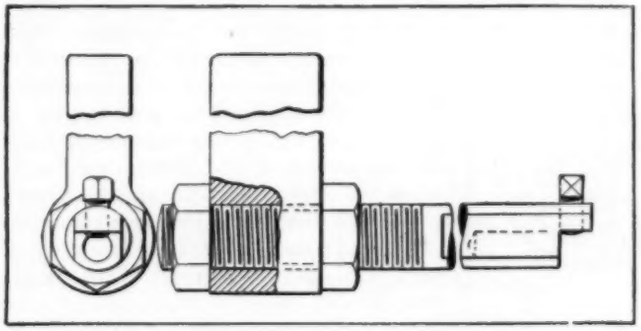
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upward, depending upon their merit.

Toolholder for the Shaper

By H. J. Gustav Kopsch

By the use of the toolholder shown in the illustration we have been saved from making a great many forged tools of various shapes. It is remarkably stiff, since the pressure of the cut falls in a direction parallel with the center of the ⅞-in. bar.

The bar is threaded at one end to fit the tapped hole in the shank and is kept from turning by a nut on each side of the shank. The opposite end is fitted to carry



A convenient toolholder

"O.K." bits. Flats on opposite sides of the bar provide means for a wrench to keep it from turning while the nuts are being tightened.

Since the bar can be revolved a full circle, work can be machined at any angle within that at which the shaper head can be set. Provision is made for considerable lengthwise adjustment of the bar in the shank, making it particularly useful in shaping otherwise inaccessible parts of work.

A Method of Checking Threads —Discussion

By Wm. S. Rowell

The relative methods of measuring screw threads (as discussed by Charles Kugler and Arthur Silvester on page 877, Vol. 65 and pages 468 and 906, Vol. 66 of the *American Machinist*) seem to call for a little further elucidation.

The method described by Mr. Kugler is about the only one usually accessible for the measurement of chaser threads, and, in the case of U.S.F. or other flattened- or rounded-top threads, it presents considerable difficulty because the permissible variation in the flat is such that to depend on the flat is risking the accuracy of the thread-measurement. It should also be noted that calculating the correct size of the wire to be used is easy enough, but securing that exact size in a straight, hard, smooth, accurately-round wire is very difficult.

The feeling expressed by Mr. Silvester in regard to the merits of wires and thread micrometers are hardly justified by the facts. While it is true that, because of small area of contact, wires have a tendency to sink into the work, it is also true that because of the broad contacts of a thread micrometer, the opposite error in measurement is very likely to occur.

The usual difficulty encountered in attempting measurements of screw threads with a thread micrometer is shown in exaggerated form in Fig. 1. The thread micrometer tends to ride high on any inequality left by a slightly failing tool point. A wire small enough to find this spot could be used with a micrometer spindle like that shown in Fig. 2. All toolmakers need such a micrometer.

If one is provided with a variety of wires, something of an analysis of the size and angle of a thread may readily be obtained by the use of several sizes of wire as shown in Fig. 3. This method, of course, involves a little in the way of calculation, but those of us who do not carry the necessary formula in our heads can get it out of our *American Machinists' Handbooks.*

We have all heard for many years of the "pitch line" of a screw thread. Really, is there any such thing? While it is true that one may imagine a cylinder having a diameter equal to the nominal size of the screw, less once the thread depth, and may call its surface the "pitch line" and its diameter the "pitch diameter," what is

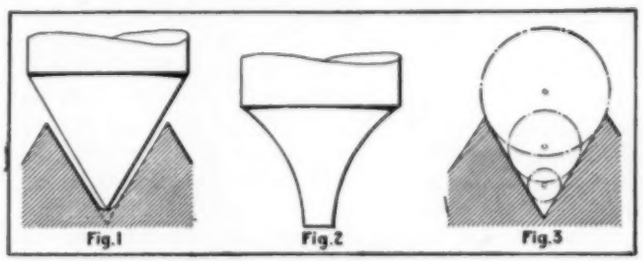


Fig. 1—Exaggeration of error in measuring V-threads with a thread micrometer. Fig. 2—Micrometer spindle for use with very small wires. Fig. 3—Analyses of thread form by the use of wires of different diameter

gained by this flight of fancy? Instead of borrowing a mechanical term that for a long time has had, and *still has,* its meaning and use, and applying it where it never can be correctly applied, should we not use some other more applicable and less overworked term? The need of a term for the cylindrical surface coinciding with equal width of thread and thread groove is freely

granted, but why use the sadly overworked term "pitch?"

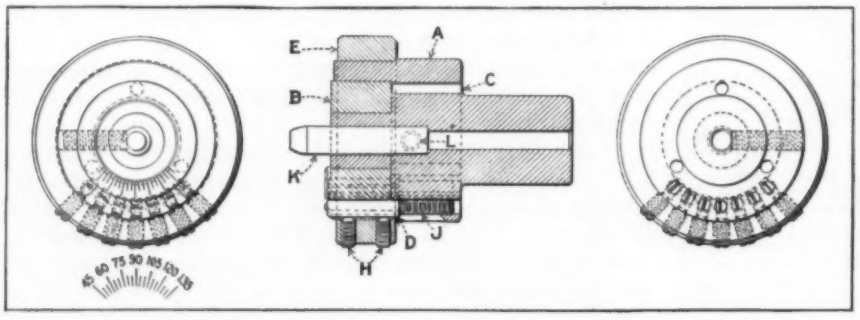
I would earnestly appeal to my fellows to, as far as possible, discontinue the use of all ambiguous and doubtful terms. Cannot someone suggest a better name than "pitch diameter" for the diameter of a screw at one-half the depth of the thread? Would not thread-diameter, meaning the diameter of the center of the thread, measured radially—be a much better term?

Protractor Stamp with Interchangeable Figures

By Henry Simon

For reasons of economy, stamping the protractor scale shown at the lower left was decided upon as the way of graduating, but it proved to be a costly job at first. The material was cold-rolled crucible steel, and the stamp a one-piece affair such as would ordinarily be used for such work. It was soon found that though the graduations stood up well, failure of some one of the figures occurred at an early stage, rendering the stamp unfit for further work.

The composite stamp illustrated was then made. It not only ended the loss of the entire stamp, resulting from the breakage of a single figure, but it actually



Stamp with interchangeable characters

lengthened the life of the individual figures themselves, and besides, it improved the appearance of the work. These advantages were due to the fact that it was possible to adjust each figure to the proper depth, where in the one-piece stamp, through warpage during heat-treatment and other causes, some figures stood out slightly beyond the rest and were forced in deeper than others, so that they were subject to excessive strains.

The holder consists of the body *A* provided with an annular recess in which the protractor-scale die *B* is a light force fit, removal being rendered possible by the three knockout holes *C*. Opposite the graduations, seven radial slots are milled in the periphery of the body *A* to form seats for as many rectangular figure stamps *D*. A heavy ring *E*, snugly fitting over the area on the body containing the slots and abutting against a slight shoulder above, is provided with seven pairs of setscrews *H* which serve to keep the figure stamps in position against the face of the protractor die. The depth of the figure stamps is regulated by adjusting the setscrews *J*, of which there is one above each stamp. The guide pin *K*, held in position by set screw *L*, merely serves to center the stamp on the work.

It will be noted that the milling of the slots is carried slightly below the inner surface of the annular recess in the bottom of body *A*. In this way, each punch registers against the face of the protractor die only.

The first thought had been to drill holes and use round-shank figure punches, but it was decided that the construction shown would be much superior. In the first place, the rectangular punches needed no locating means to keep them turned right. Besides it was in this way possible to remove and replace the punches without taking the die out of the press. The punches are a loose, sliding fit in the slots and can be gotten at from above, so that it is necessary only to loosen two set-screws to withdraw any punch. Since all punches, including several sets of spares, were ground to the same micrometer measurement from the face of the figure to the end, they could be used to replace the damaged punches with the assurance of being correctly adjusted.

Turret Lathe with Support for Tools

By Milton Wright

The machine shown in Figs. 1 and 2 was adapted in the shops of the Smith & Winchester Manufacturing Co., makers of paper machinery, to bore and ream gears, gear blanks, handwheels and similar parts that are not finish turned and thus depend upon the accuracy of the bore to make them run true. Some of the parts to be bored and reamed have much longer hubs than the one shown in the chuck, hence the necessity for the fixture to support and guide the tool bars. This fixture consists of two main parts; the lower one fitted to the shears of the lathe bed, and held in position by a bolt and strap in the same way that the tailstocks of old lathes are held, while the upper member—the A-shaped frame—is hinged to the lower one at *A*, Fig. 1, and secured in front by a latch and eccentric lever. The large boss *B* was bored in place in the machine to fit the outside diameter of a set of slip bushings, the bores of which are in turn fitted to the various tool bars. To remove the frame while chucking the work, drilling it, and making the preliminary cuts, the latch is disengaged and the frame is swung back on its hinge to rest on the bar *C*, bracketed to the rear of the lathe bed. In this position it is entirely clear of the turret, so that the tools of the latter may be used without interference.

To make the finishing cuts, or to ream a bore, the frame is swung down to position and latched as here shown. The slip bushing, already placed on the tool bar

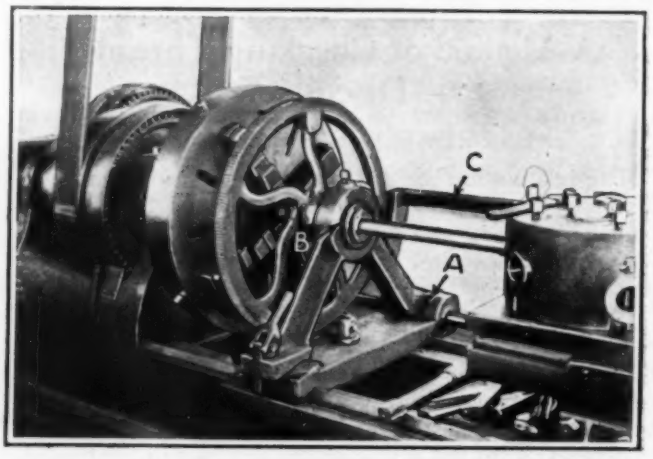


Fig. 1—Fixture to support tools close to cut

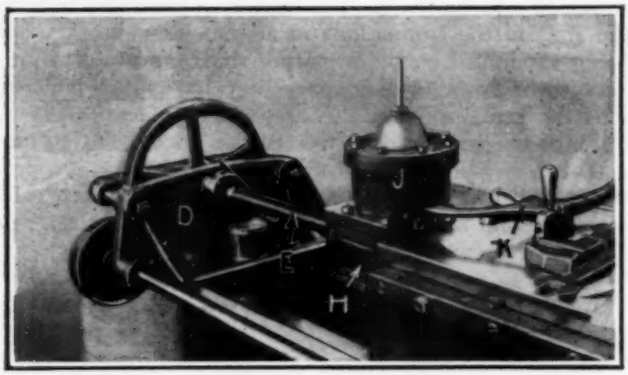


Fig. 2—Feed mechanism of the turret slide

when the latter is first set into the turret, is entered in the boss, assuring accuracy of alignment and a rigid support close to the cutting point.

The feed movement of the turret, shown in Fig. 2, consists of a bracket *D*, attached to the shears at the end of the lathe bed, a screw *E* and suitable gearing to drive it, and a split nut, a part of which may be seen at *H* where it is secured to the rear end of the turret slide. The cylindrical chamber *J* contains a large helical spring to hold the halves of the split nut normally out of engagement with the screw. The lever *K* closes the nut against the action of the spring.

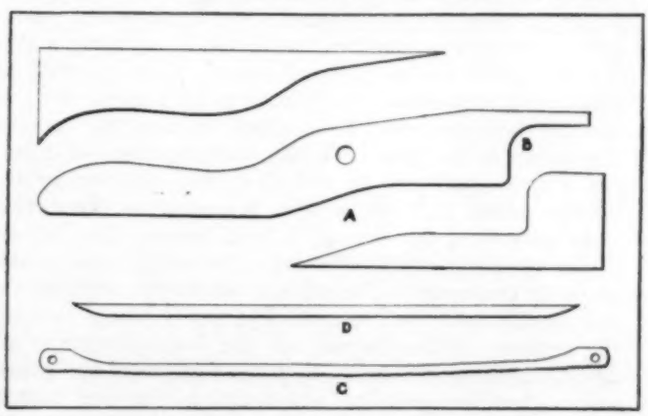
When the nut is engaged, the lever *K* latches in position and so remains until released by the latch striking against an adjustable dog on the stationary member of the turret base. The screw gears derive their motion from the tumbler gears on the back of the headstock, through a shaft at the rear of the machine.

Cutting Curves with a Hacksaw

By Joseph M. Slabey

It was necessary to cut some pieces as shown at *A* from $\frac{3}{16}$ x 12-in. iron. Having no nibbling machine, a hacksaw was the only means available with which to do the work.

Since ordinary hacksaw blades are too wide for cutting curves of such short radius as the one shown at *B*,



The work and the saw blade

I took a blade that was not hardened at the back and narrowed it as shown at *C*, using a pair of tinner's snips. The piece cut from the blade can be seen at *D*.

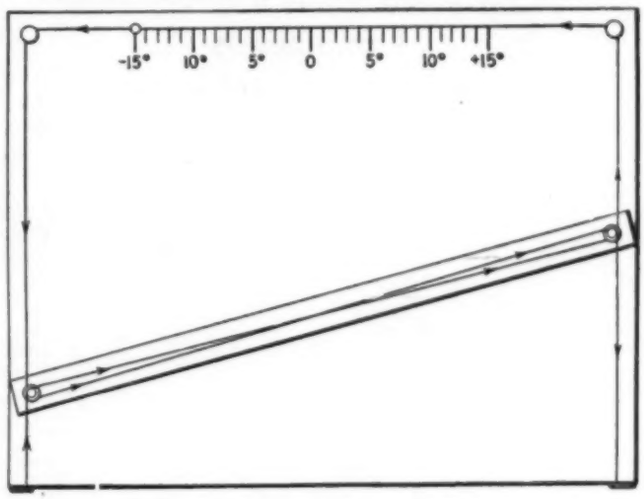
The narrow blade acted the same as the compass saw used by carpenters, and I had no difficulty in making it follow all of the curves.

Protractor for Parallel Straight-Edge Drafting Board

By John F. Hardecker

The increasing use of the parallel straight-edge in place of the T-square, creates a particular interest in any unusual adaption of the parallel edge designed to save still further time in its use. A permanent and quickly adjustable protractor can be made a part of a drafting board so equipped in a few minutes time.

With the parallel straight-edge in its normal (square) position, stick a thumb tack through the upper cable into the board at about the center, marking the point on the board zero. In normal operation, this thumb tack stays fixed and the marked hole permits the straight-edge to be returned to the square line after having deviated from it either purposely or accidentally. Next lay off a line 15 deg. from the horizontal at any place on the board, and releasing the thumb tack from the board, but not from the cable, adjust the straight-edge to this 15-deg. line. Press the thumb tack into the board at its new location and



How the board is graduated

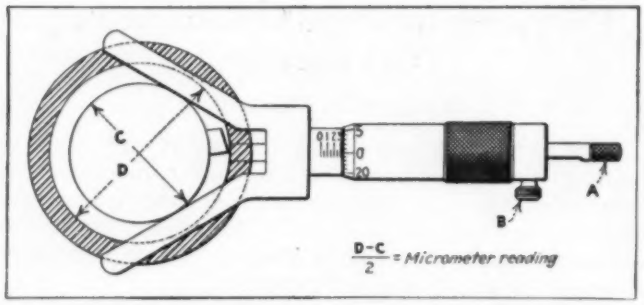
mark this point 15 deg. Divide the space between zero and 15 deg. into 15 equal spaces, marking each on the board, and lay off the same divisions on the opposite side of zero. Now, with the use of the 45-deg. and 60-deg. triangles it is possible to get any angle desired. In order to draw a series of lines at this angle, one shift of the thumb tack from zero to the desired angle accomplishes it, a triangle being used if required. The simplicity and ease of this arrangement and its rapidity are obvious. Its operation has proved practical in the drafting room.

Gage for Setting Boring-Bar Cutters

By B. R. Sheets

The setting of cutters in boring bars where fairly close limits are required, is often the source of considerable cut and try methods with consequent loss of time in the set-up.

The illustration shows a gage devised to speed up cutter setting. In operation, with the forked end straddling the boring bar, the plunger *A* is set to the surface of the bar while the thimble is at zero. The plunger is then locked by the knurled-headed screw *B*. All that remains to be done is to back up the thimble one-half of the



Setting-gage for boring-bar cutters

difference between the diameter of the bar and that of the hole to be bored, and set the cutter against the spindle.

No doubt there will be cases where the bar is not absolutely true, or has been scored by chips, in which case an accurate setting cannot be made, though the gage provides a means of measuring that will reduce the number of cut and try operations.

Pillar-Press Tools for Armature Laminations

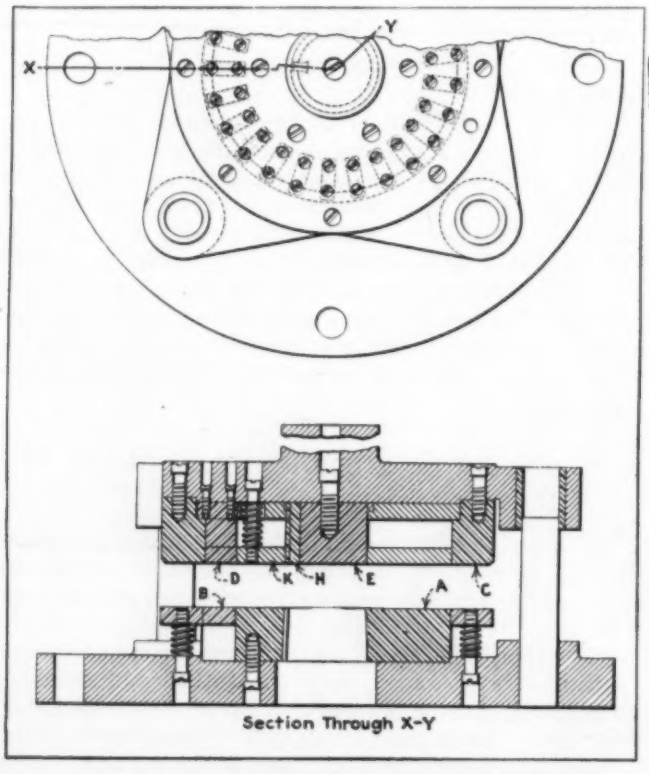
By Edward T. Heard

A set of pillar-press tools for punching notched armature laminations for generators, is shown in the illustration.

The die *A* is made in one piece and is let into a recess in the die shoe, being held in place by screws and dowel pins. The ring *B*, sliding on vertical pins and supported by a number of coil springs, acts both as a pressure pad and a stripper for the scrap.

The blanking punch *C* and the ring carrying the notching punches *D* are doweled and screwed to the punch holder. The central holes in the laminations are pierced by the punch *E*, into which is dovetailed the insert *H* for cutting the keyway. The keyway is necessary to keep the slots in the laminations in alignment while they are being assembled on the armature shaft, and also to prevent them from turning after they have been built up into the armature core.

Since the laminations stick to the punch, the spring-actuated stripper *K* is provided. The four guide pins of the pillar press are forced tightly into the base, and the guide-pin holes in the punch holder are bushed.



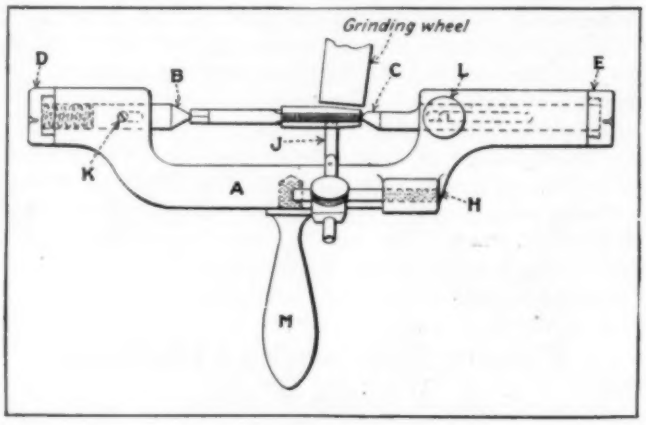
Tools for punching armature laminations

Fixture for Tap Sharpening

By Robert Julian
London, England

While machines for sharpening twist drills are in common use, there appears to have been little done in the way of bringing out machines or fixtures for sharpening taps.

To get rid of the tedious job of sharpening taps by hand grinding, the fixture illustrated has been designed. The cast-iron body *A* has two lugs or projections that are bored in line to receive the work-holding centers *B* and *C*. The ends of the lugs are fitted with caps as at *D* and *E*, in which are holes drilled and countersunk about $\frac{1}{16}$ in. off-center. At *H* a hole is drilled and tapped to receive a bar for carrying the spring index-finger *J*. The center *B* has a short longitudinal movement in its hole, limited by the screw *K* engaging a slot, and is backed up by a helical spring. The purpose of the spring is to allow the center to be pushed back so that the tap can easily be inserted between the centers. The center *C* is adjustable to accommodate taps of different lengths, and can be locked in any position by the binding screw *L*. The handle *M* completes the device.



Device for sharpening taps

In operation, the fixture is held between the centers of any grinding machine having a swiveling table capable of being traversed. The table is set to the angle of the part of the tap to be ground. The tap is placed between the centers of the fixture and the index finger is adjusted to bring the lands in proper position for grinding. Then the grinding wheel is brought into contact with the tap and the fixture is oscillated while the table of the machine is traversed, giving the tap an eccentric relief.

In indexing the tap from one land to another, the machine table is brought to rest in such position that the wheel will be opposite the flat ground on the center *C*, so that there will be danger of the tap touching the wheel during indexing.

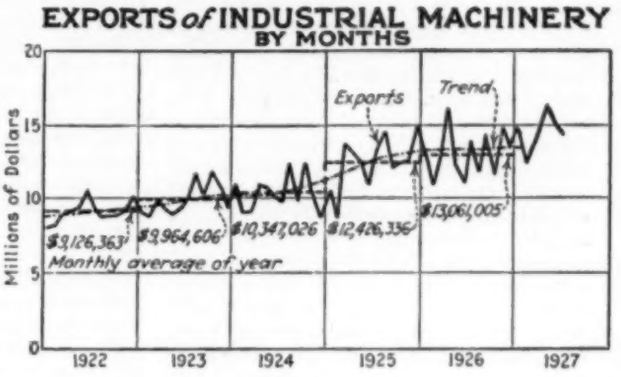
Activity in the Metal Working Industries

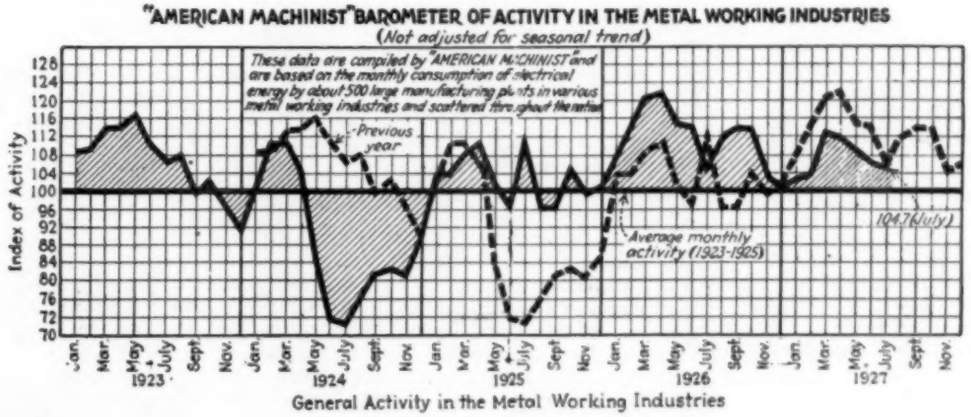
Operations Slightly Below Level of Last Year

The operations of the metal-working industry continued their downward trend during July, the productive activity during that month being about 1 per cent below that of June, and about 7.3 per cent below that of March, the peak month of the year. Last year the July activities were about 12 per cent below those of the previous April, the peak month of activity during that year. The indications are, therefore, that the metal-working plants, while decreasing their operations as a result of seasonal influences, yet have not recorded as large a decrease as was anticipated by some. The July operations were about 2 per cent below those of July last year, which was, however, an unusually good year for industry and business. Such is the status of activity in the metal-working industry based upon the consumption of electrical energy by a large number of the metal-working plants scattered throughout the country as collected by the *Electrical World*.

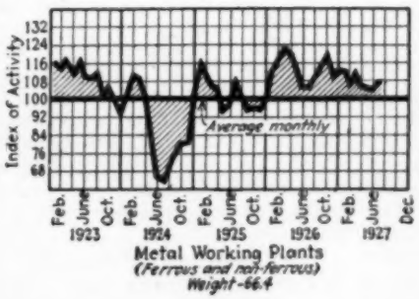
There are reasons for believing that this year's low point of activity in the metal-working industry was reached during July. Operations in the automobile manufacturing plants will probably be increased during August as was the case last year. Present conditions also point to an immediate increase in the operations of the ferrous and non-ferrous metal-working plants.

Export of industrial machinery continues to remain consistently above the level for 1926 according to figures furnished by the Industrial Machinery Division of the Department of Commerce. Exports for June totaled $14,208,000, representing an increase of more than $3,000,000 over the corresponding month of 1926. Machinery shipments for the six months ending June 30 amounted to $87,743,000, as compared with $76,249,000 for the corresponding period of last year. The largest increases in machinery exports are in oil-well machinery and metal-working machines. Shipments of metal-working machines for the six months' period amounted to $11,049,000, as compared with $9,260,000 for the same period of the previous year.

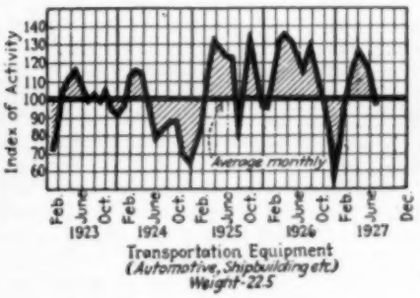



"AMERICAN MACHINIST" BAROMETER OF ACTIVITY IN THE METAL WORKING INDUSTRIES
(Not adjusted for seasonal trend)
These data are compiled by "AMERICAN MACHINIST" and are based on the monthly consumption of electrical energy by about 500 large manufacturing plants in various metal working industries and scattered throughout the nation
Previous year
Average monthly activity (1923-1925)
104.7 (July)
Index of Activity
1923
1924
1925
1926
1927

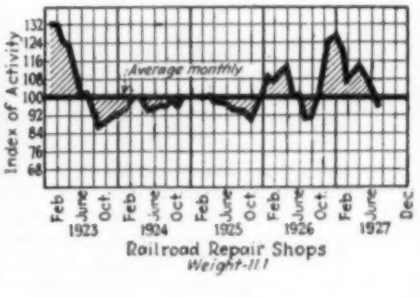
General Activity in the Metal Working Industries



Metal Working Plants
(Ferrous and non-ferrous)
Weight-66.4



Transportation Equipment
(Automotive, Shipbuilding etc.)
Weight-22.5



Railroad Repair Shops
Weight-11.1

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Technical Abstracts

Large Railway Shops for Rome

Large shops for general repair and overhaul work are being constructed in the suburbs of Rome, Italy, to handle the repair work for the 670 cars belonging to the local tramway system. The new shops will cover an area of about 18 acres, and will comprise a machine shop, forge shop, electrical shop, woodworking department, and a large general overhaul shop containing 24 tracks. In addition, provision will be made for painting, assembling of accessories, and for general storage. All of the cars now in use on the lines of the company have single trucks, and 400 of them are equipped with motors, the remainder being trailers.—*Electric Railway Journal*, July 23.

Welded Steel Frames for Special Machines

In making complicated parts for special machinery, welded steel construction may prove better for the purpose and more economical than gray-iron castings. Steel parts will not break; the most that is likely to happen is the deformation of the pieces. A steel part thus affected may be returned to service by correcting the distortion. Additional strength may be secured at any point at negligible cost. On the other hand, failure of a casting means at least a new casting, and, in case of defective design, a new pattern.

The utility of a special machine is dependent to some extent upon the cost of the machine. More special machines would be used if the costs were reduced. Patterns are an essential element in the cost of special machinery. Welded steel construction eliminates pattern expense and substitutes a method in which the work is done directly from the drawings. Usually the welded steel piece costs less than the casting alone, not considering the pattern cost.—R. E. Kinkead, *Machinery*, August.

The Mitten-Braley Airplane Control

A demonstration was made recently at Clover Field, Santa Monica, Cal., of an airplane under automatic control of a device that functioned sufficiently well to allow the sole occupant of the plane to desert the pilot's seat and walk out on one wing, without disturbing the equilibrium of the airplane. This demonstration was a test of the "Mitten-Braley Airplane Control," the invention of Robert E. Mitten, aeronautical engineer of Santa Monica.

The entire mechanism weighs less than twenty pounds and is installed, out of the way, in the fuselage to the rear of the pilot's cock-pit. The automatic operation of aileron and rudder surfaces is accomplished by means of a controlled flow of air pressure to each.

The most important element devised in the operation of the control was the invention of a highly selective valve governing the flow of air pressure, which makes possible the varying of pressure in the operating cylinders. The control surfaces are moved in exact accordance to the variation of the plane from normal flying position. Each movement is made in proportion to the ships deviation from normal, applying the correction gradually and proportionately as the plane leaves a lateral or longitudinal level and relieving the correction just as accurately as the ship resumes its normal course.

It is the belief of the inventor that a plane equipped with this automatic control does not necessarily have to have the high degree of inherent stability generally demanded of a plane, thus permitting high maneuverability and at the same time automatic stability when the occasion demands, a particularly valuable characteristic for army and navy airplanes.

Mitten does not contemplate the use of his invention as a means of replacing a pilot in an airplane to the extent of permitting the layman or inadequately experienced pilots going aloft. Its chief value, he believes, will be found in night flying, fog flying, and as a switch over to allow a pilot relief from the control on extended flights.—*Aviation*, July 11.

Abrasive Garnet

Garnet is a name given to a group of minerals consisting of silicate of either aluminum, calcium, magnesium, iron, manganese or chromium. Many of the species of garnet vary considerably as to color, hardness, toughness and method of fracture. For the best abrasive purposes the mineral ought to be 7.5 in hardness. When the garnet is crushed the grains should break into sharp, angular fragments without curves or rounded edges. The mineral should be so tough as not to break too easily, and so brittle that the individual grain will break and form new cutting edges rather than become rounded. Up to the present the highest grade of abrasive material has been obtained from the large crystals of red garnet, such as occur in New York State. Almandite is by far the commonest of the garnets, and is the type most employed for abrasive purposes.

On the American Continent garnet-coated papers and cloth are used almost to the exclusion of all other forms of abrasives in the woodworking industry, particularly for sanding hard wood. For soft wood garnet and quartz papers appear to be nearly equally efficient, since both are soon clogged with the wood particles. But for hard wood the superiority of garnet over quartz is pronounced, and the cutting of the garnet is said to be from two to six times that of quartz. Garnet papers are also used for the finishing of hard rubber and celluloid. In recent years fine garnet papers have taken the place of pumice in the rubbing down of varnished and painted surfaces, especially for automobile bodies. The different grades of garnet used on papers and cloth range from No. 5, the coarsest, which is about 15 mesh, to 70, which is about 220 mesh. There are about a dozen manufacturers of garnet-coated paper in the United States and two in Canada.—V. L. Eardley-Wilmot, *Abrasive Industry*, August.

What to Know in Buying Die Castings

As in many other things, when buying die castings it is necessary to bear firmly in mind that first cost is not the all-important element, considering that a poor die will not give satisfactory results in the user's product.

The buyer of die castings must act as an intermediary between the engineering department of his own company and that of his supplier. With the assistance of the supplier's trained engineers and metallurgists, the buyer is able to make many recommendations to his plant engineers that invariably result in substantial reductions in cost. The buyer who will establish such a contact with dependable sources of supply, and deal with his suppliers on a fair and equitable business basis, will always buy the best product and ultimately at a minimum cost.

On the other hand the usual procedure in buying die castings, often resulting in confusion and costly delays, is as follows:

The engineering department designs a part and submits blueprints of this part to the purchasing department for bids on die castings. In the absence of any information to the contrary it is natural for the engineering department to assume that the supplier will deliver castings as per blueprint but this is what often happens:

Some buyers on receiving bids, simply compare prices and disregard any accompanying comments, which, however, may result in finally receiving samples not corresponding with original blueprints and often requiring additional operations, which the buyer's engineering department has not planned for. To avoid any possibility of misunderstanding the buyer should insist that the die-casting supplier submit a blueprint before starting on the die, showing exactly how the supplier expects to deliver the part.

The following information is essential to an intelligent bid: 1—Application of part. 2—Service conditions. 3—Present method of manufacture. 4—Material now used, if satisfactory. 5—

Surface finish required—if plated, polished or enameled. 6—Approximate yearly requirement.

It is self-evident that the reliability and experience of the supplier should be carefully considered by the buyer before placing an order. Some buyers, doubtful of the reliability of their source of supply, believe that by stipulating their right to remove the die, they have fully protected themselves. In actual practice this procedure proves futile for the following reasons:

Fundamental mistakes in die design often cannot be corrected unless a new die is constructed. Furthermore, the type of die designed by any supplier will depend to a large extent upon the particular type of casting machine used by this supplier. Very often such die is of no value to a competitive supplier. Die-casting manufacturers usually stipulate that the dies must remain in their possession, and while some buyers take exception to this practice, it is based on sound business ethics.

In conclusion the writer emphasises that in his experience with purchases of die castings he has found that the most successful buyers adhere to the following procedure:

Carefully choose one or two dependable and reliable sources of supply. Put your die-casting problems squarely up to these suppliers. Do not attempt to tell your suppliers how to construct the die or what alloys to use. Assume that your supplier knows more about die casting than you do. Tell him what results you want and let the supplier do the rest. If the supplier is progressive and conscientious, you will never have any trouble buying die castings, and although you may not buy cheap die castings, your ultimate die casting costs will be lower than if you buy on the haphazard, hit-or-miss basis. — Charles Pack, *The Iron Age*, July 21.

Who Pays for Steel Warehouse Service?

Delivery charges on small lots are among the most expensive items for the average warehouse. It costs the average warehouse from $3 to $4 to put a charge through its books, no matter what the size, yet some months ago a large, well organized steel warehouse made an analysis of its own business and discovered to its astonishment that 58 per cent of its orders were under $10 each, and 41 per cent were $5 and under. This gives cause for serious thought as it may be stated that the problem of the small order in the iron and steel jobbing industry is not an exception. Every warehouse in the country today faces this problem.

Throughout all industry the tendency during the past five years has been markedly toward smaller orders. This movement has been fostered by increased transportation facilities. Probably no single instrument has contributed so greatly to the habit of buying for daily needs only as the motor truck. Small order buying has revolutionized many industries and eliminated some.

Although for the larger warehouses small orders come in groups and are more or less consolidated so that regular deliveries take care of certain districts, nevertheless, customers at best are widely scattered and the warehouse is lucky if a rush order means a side haul of less than three miles which is a round trip of six miles.

A large metropolitan warehouse now operates trucks with a total capacity approximately double that in 1923, since which date the company's business expressed in tonnage has remained practically stationary. To take care of the increased demand for service, and to keep abreast of the strenuous competition, warehouses have been forced to install elaborate labor-saving machines that have added greatly to the capital requirements.

In addition to the delivery service demanded, customers are constantly calling for more and more cutting service. Bars, angles, shapers, cold rolled shafting and almost every bulk commodity are now ordered cut to length and the extras for cutting are wholly inadequate to cover the cost.

The solution of the whole problem for the large warehouse, of course, is not in cutting down service. More and better service must continue to be given but somehow proper pay for this service must be obtained.—H. R. Simonds, *Iron Trade Review*, July 21.

1,400 Per Cent More Cars with 10 Per Cent More Men

To the automobile production man the lack of production control in other industries is surprising. It is the only salvation of the manufacturer caught between high wages and material costs, and low selling prices. With adequate production control less manufacturing space is required, inventories of raw and finished material are greatly diminished and there is less work in process. The savings represent profits.

The Buick Motor Co. is an example of what can be done. In 1920 the capital turnover rate was one tenth of the 1926 rate. In 1912 three assembly lines, longer than the ones in use now turned out 80 cars a day. The figure is now 1,200 a day. The floor space has been increased 25 per cent in 15 years. Leaving out the men employed in making parts that were purchased in 1912, the payroll has been increased by about 1,600 men, 10 per cent. Not over 10 per cent of the floor space is used for storage of any sort.

Production control is the operation of sensible budgeting on the production side. It starts with the sales schedule and co-ordinates and synchronizes purchasing, deliveries and transportation, materials storage, handling, processes, parts, stocks, and storage, to the end that the capital investment may be a minimum. Many parts that could be bought for practically the same amount are made in the plant to insure absolute control. Only five parts are purchased: Frames, lamps, starting and lighting equipment, steering gears and closed bodies. Nowhere in the plant is there room to store a day's supply of any finished part except frames, and they are out in the yard. Taking material directly from the freight car to the production machine saves an extra handling. Many processes have been shortened, painting for example, but the real saving comes from scheduling and improved methods. Parts are no longer put in toteboxes between operations. The machines are close enough so that the work goes from machine to machine without interruption. Thus the manufacturing operations approach a continuous process.

The Buick plant makes 19 domestic models, plus variations for export, such as right-hand drive. Preliminary production schedules are worked out two months in advance, and revised every two weeks. The actual building schedule is made up one day in advance when it is decided exactly how many cars will be built the next day, including the number of each type and even the finishing color. Because there are variations in the chassis, corresponding bodies and chassis must arrive at the final assembly line exactly in sequence. This sort of scheduling is necessary through the subassemblies as well.

Manufacturing operations are not "protected" by a small reserve stock; transportation operations are. Thus, closed bodies which come 60 miles by truck are protected; open bodies built in the plant are not. The zeal for small inventories is tempered with common sense by buying or making in optimum lots. It has been found better to shut down the plant through mischance than to guard against it by carrying reserve stocks—and then seeing that mischances do not occur.—Cady B. Durham, *The Magazine of Business*, July.

Wax Lubricants

The solution of lubrication problems is particularly hard in the case of telephone equipment, for example in the machine-switching field where parts are small and cost and space are important considerations.

A lubricant to be satisfactory must be non-evaporating, on account of the long life of the equipment itself; it must be adherent, but not sticky or corrosive; must not spread; and must be a non-conductor. The last requirement is of paramount importance and bars a lubricant excellent in other respects, graphite.

For the hard rubber roller of a lever-type key, after experimentation with various substances, thorough satisfaction was obtained by dipping the roller into melted ceresin wax, a substance similar to paraffin but with a higher boiling point. The excess wax is drained off and a light coating is left, most effective in reducing wear and friction, which meets the ideal requirements in all respects.

Wax is not the solution for all the problems of telephone lubrication, but for an important group its usefulness can scarcely be overstated. — D. W. Mathison, *Bell Laboratories Record*, July.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Bargains in Buying Machinery

BUYING machinery is something of a problem at best. For we are all more or less bargain-hunters and like to think we have bought something at a lower price than someone else. And it is this characteristic that frequently gets us into difficulties.

If it were a question of buying a well-known, standard make of machine at a special price, few of us would hesitate at all. Although even then we would know that someone was not getting a fair profit in the transaction. But it is usually a case of choosing between the machine we really want, or another make at a lower price—of convincing ourselves that the second of third choice will answer our purpose, and that the difference in price is really saved.

The capital available for investment must play a large part in our decision. And we should be sure that it is an investment and not an expense. Then we must decide as to whether the added investment in the higher-priced machine will show adequate returns.

There are few cases, however, where the reputation of the builder does not play an important part. Even if we have never used his machines, his reputation for good design, workmanship and fair dealing makes one feel safe in paying a higher price than when this is not the case.

The main thing is to realize that we rarely get something for nothing. As Ruskin is credited with saying, "There are always those who can make things a little cheaper and a little poorer."

Close Tolerance in "Air Fits"

NEW machinery and new methods have made it possible to secure accurate work at moderate costs. And because of this there is a tendency on the part of some designing engineers to set close tolerances on all parts, regardless of the necessity for them.

No production manager wants to turn out work that will not function properly in the finished machine. But he realizes, even better than the engineering department perhaps, what parts require extreme accuracy. And he knows costs well enough to realize that it is a waste of money to demand close tolerances where they are not necessary.

The particular annoyance of the production manager is to get blueprints that call for close tolerances on "air fits"—that is, on dimensions that have no contact with other parts of the mechanism. And those who are not familiar with working blueprints can hardly realize how often this occurs. Knowing that tolerances of half and even quarter thousandths can be maintained where necessary, designers and engineers are prone to consider one or two thousandths as a wide tolerance and call for it, where five or ten thousandths would answer equally well.

Production men do not want to turn out "sloppy" work—to use a shop phrase. But they all know that tools wear and men make mistakes in measuring, or gaging, at times. And when they are crowded for output it is little less than an economic crime to see pieces scrapped because of a non-essential variation in an "air fit." The main difficulty seems to be a lack of discrimination between vital and non-essential dimensions.

Reading Time: Fifty Seconds

ONE of the popular weeklies that numbers its readers in millions has instituted the practice of placing at the top of each story the approximate reading time. Is this a sign of the times? Is it an indication that in our present high-powered life the average man, before he starts to read a light story for pleasure, wants to know just how long it will take him to finish it?

If this situation exists in regard to light reading at home, how much more so is it true in daily business life where the manufacturer and business man must read and grasp as he runs the vast amount of new technical information that is being constantly put before him? The *American Machinist* has been actively engaged for several years in trying to solve this problem of giving the reader the maximum amount of new material in the minimum reading time. Whenever it is possible to show a process or equipment graphically it is being done in pictures with only enough words to give an accurate and understandable account. It has meant that costs for pictures and drawings increased 13 per cent in 1926, and 19 per cent more in 1927, but if it is saving valuable time for the reader and helping him to pick out quickly the articles to be read, it is in line with the policy of progressive service to industry that this paper has followed for fifty years.

Shop Equipment News

Heald Duplex Size-Matic Internal Grinding Machine

THE Heald Machine Co., Worcester, Mass., has brought out a machine in which concentric holes of the same size may be ground in opposite ends of a single work-piece simultaneously. This machine is a development of the standard Size-Matic internal grinding machine made by the same company and described on page 377, Vol. 64, of the *American Machinist*.

The application of the automatic sizing features of the Size-Matic machine to two holes instead of one is accomplished by the simple expedient of transferring the sizing mechanism from the wheel-slide to the work-head, which is here mounted on a cross-slide midway of the length of the machine. The wheel-slides reciprocate back and forth.

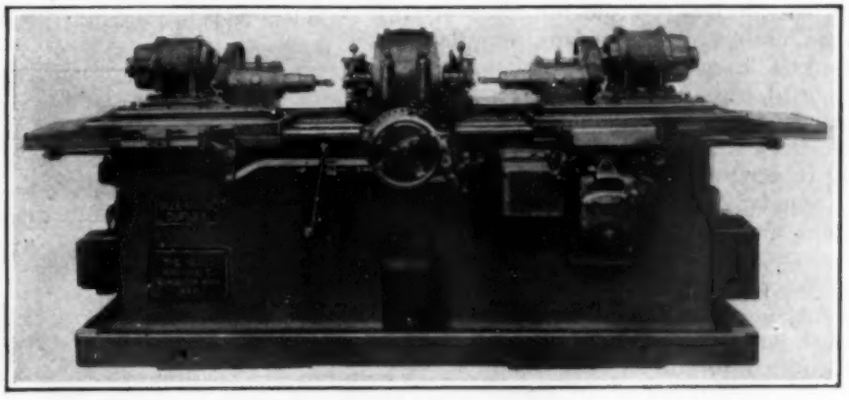


Fig. 1—Heald Duplex Size-Matic Internal Grinding Machine

The work-carrying spindle is an annular shell having a maximum internal diameter of 7½ in., and running upon two large radial ball bearings, which are assembled under initial tension to obviate end movement and eliminate the necessity for endwise adjustment. Special fixtures are necessary to accommodate whatever form or size of work-piece—within the limit of the 7½-in. diameter—that may be under production.

The workspindle is driven by a belt that runs over a spring-suspended idler from the driving pulley on the main shaft, which is located on the back of the cabinet base and is an extension, through a compensating coupling, of the rotor or armature shaft of the main driving motor. The same shaft drives the oil pump that supplies power to operate the cycle movements of the machine, the circulating pump to deliver coolant to the work and wheels, and the generator that supplies the low-voltage direct current to energize the magnetic controlling apparatus.

The cross-slide upon which the workhead is carried is provided with fine and coarse feeds, operated automatically. As the size of the holes being ground approaches the predetermined dimension the magnetic control causes the wheels to be withdrawn, the truing diamonds to swing down to position to dress the wheels, the wheels, after redressing, to return to the work for a predetermined number of strokes, and then to be withdrawn entirely at which time the cycle goes out of action.

The relative times of the various stages are adjustable one to another so that the machine may be set to produce holes within 0.0002 in. of exact diameter, and, through the mechanism to compensate for wheel wear, which is also automatic, to continue production indefinitely. The sizing is entirely by mathematical pre-calculation and no gages or gaging devices at any time enter the holes being ground.

The operative force to reciprocate the wheel-slides, to control their traverse speed during the rough grinding, dressing of wheels, and finish grinding, and, finally, their entire withdrawal from the active zone, is applied independently to the slides by two hydraulic cylinders, pistons and their connections. The two slides are, however, connected together by pinions and a floating rack, so that they move in unison in opposite directions, approaching and withdrawing from the work on either side simultaneously. The rack and pinion connection provides a means by which the relative positions of the wheels may be adjusted longitudinally.

The wheel-slides traverse upon one flat and one V-way which are at all times covered by permanent guards to protect them from injury. The ways of the right-hand slide are machined directly upon the cabinet, while those of the other are integral with an intermediate swiveling table

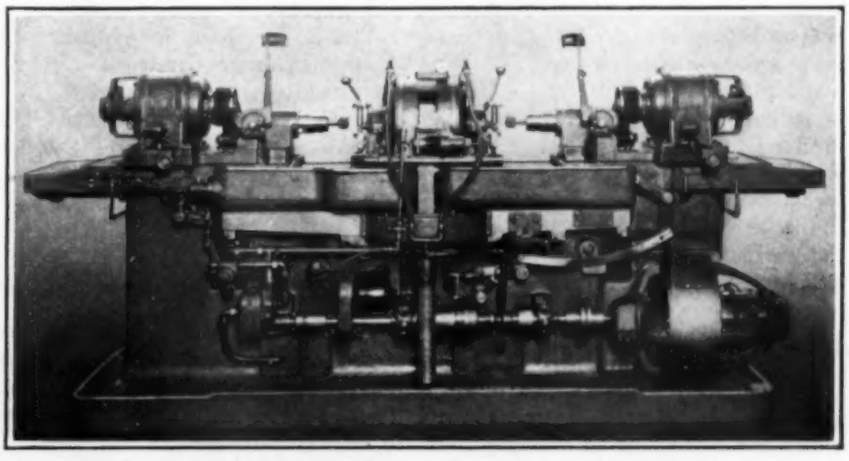


Fig. 2—Rear view of machine with guards removed

Shop Equipment News

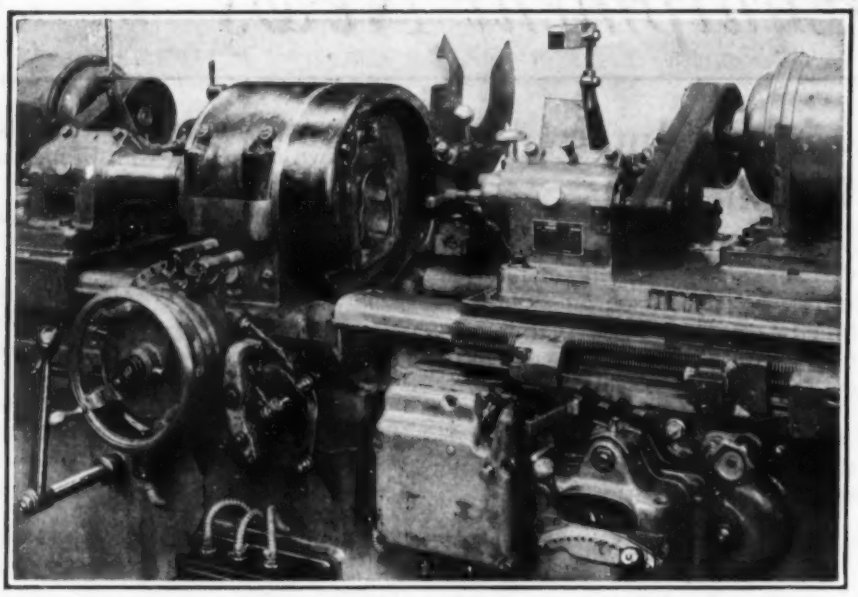


Fig. 3—Close-up of automatic control mechanism

by means of which precise alignment of the two holes may be secured and maintained.

There is no crosswise adjustment whatever of the wheel-heads. These are cast integral with the upper portion of the traverse slides, and the driving motors for the wheel spindles are adjustably mounted upon the same castings. The drive to the spindle is in each case by a belt that runs over a spring-suspended idler from the pulley on the rotor shaft. The wheel spindles and their housings each form a complete unit that may, by loosening two clamping bolts, be withdrawn from the respective head and others substituted for them.

Referring to the illustrations, Fig. 1 shows a front view of the complete machine with all guards in place and ready to operate, while Fig. 2 shows a rear view with the guards removed; in operating condition all moving parts here exposed are covered by permanent guards of cast iron. Fig. 3 is an enlarged view of the actuating mechanism of the right-hand wheel-slide, and the workhead and sizing mechanism of the cross-slide.

In the last illustration the lever at the extreme left is the trip-lever by which the cycle is started or by which it may, if necessary, be stopped at any time. The ball-handled lever at the right is the control for the traversing movement (which in turn governs all other movements) by which the directions of traverse may be reversed. This illustration also shows the dogs, trip-levers and cams by which automatic control is effected and adjusted.

Above the ratchet at the left are the electrical contact devices through which the magnetic control box exercises control over the functions of the machine. By means of the throttle lever at the extreme lower right of Fig. 3 the speed of reciprocation may be regulated, without arbitrary steps, to any rate from 0 to 50 ft. per minute.

Standard equipment for the machine includes one workhead without fixtures, two wheel-truing diamonds, mounted; one main driving motor of 5 hp. and two wheel-driving motors of 5 hp. each. The motors can be furnished for direct current, or for alternating current of any commercial voltage, phase and frequency. Water attachments, extra wheelheads, belts and wheels are extra.

The cabinet base, in which the hydraulic cylinders and oil reservoir are inclosed, is surrounded by a channel at floor level to catch any overflow or coolant or oil. The floor space occupied by the machine is 30¾ x 108 in., and the net weight is 8,500 pounds.

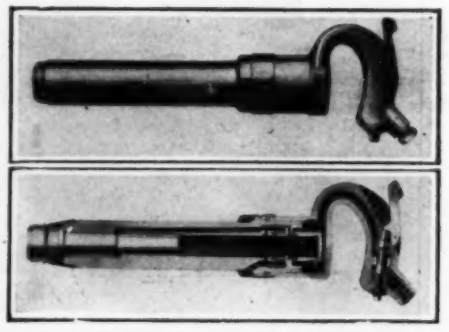
"Cleco" Riveting Hammer

The "Cleco" riveting hammer illustrated was recently placed on the market by the Cleveland Pneumatic Tool Co., Cleveland, Ohio. It is said to be well balanced.

The chief feature of the tool is the main valve upon which depends the successful operation of the hammer. The valve is tubular in form, and piston passes through it at each stroke. The valve is actuated by live air in both directions to insure a uniform and steady action. It is short, light in weight, and has solid walls free from port holes. At the lower end it is reinforced as a protection against injury from piston slap. Pistons of different lengths may be used without detriment to the tubular valve. A cushion chamber is provided in the rear end of the valve block integral with the block and in alignment with the valve and cylinder. It is said to absorb all shock or recoil on the return stroke of the piston.

An air reservoir is provided between the outer walls of the valve block and the inner bore of the handle. It forms what is called a "power pocket" in which air is stored up and discharged on the piston at the beginning of each stroke, thus increasing the speed and force of blow, it is claimed.

A safety lock holds the handle on the cylinder and is so constructed



"Cleco" Riveting Hammer

that easy and close adjustments may be made as the hammer becomes worn in service. It consists of a locking ring with teeth milled in the upper side to engage similar teeth milled in the lower edge of the handle together with keyways cut on the inner side to engage similar keyways cut on the cylinder. A spring clip holds the ring and cylinder together and further provides an outlet for exhaust air; the clip can be turned so as to deflect the exhaust air away from the operator.

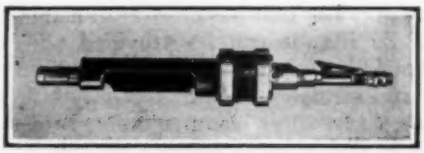
The balanced throttle valve is operated by a lever which has a reasonably free action before engaging the valve. The valve operates within

Shop Equipment News

a steel sleeve seated in a recess provided in the handle. Both of these are hardened and ground in position. The valve action is said to be smooth and even and to provide a fine regulation of the air supply.

Buckeye No. 63 Portable Polisher and Grinder

The Buckeye Portable Tool Co., Dayton, Ohio, has brought out an air-driven tool for polishing and grinding the side rods of locomotives. It can also be used for all other flat surfaces. The tool is 27 in. long over all, 4½ in. in diameter at the largest point, and weighs 15 lb. complete. The wheel rotates at 6,000 r.p.m. and polishes a surface 6 to 9 in. in width.



Buckeye No. 63 Portable Polisher and Grinder

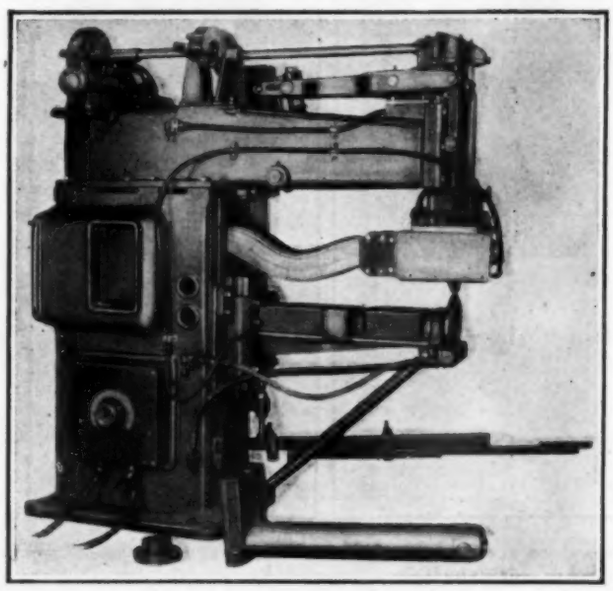
The tool operates on the rotary principle, and has only four moving parts. It is said to be a smooth running tool, simple in construction and light in weight. The operator takes the tool in both hands, places the polishing wheel over the part wanted to be finished, presses on the safety control valve in the handle near where the air enters and starts the rotor.

Thomson No. 375 Double-Roller Seam Welder

WHAT is claimed to be an extremely rugged and universal seam welder designed for long life, simplicity of operation and continuous production, was recently placed on the market by the Thomson Electric Welding Co., Lynn, Mass. It is known as the No. 375 double-roller seam welder and is shown in the accompanying illustration. It has a capacity for welding two pieces of No. 22 gage to ⅛ in. iron or steel, depending on the length of seam and the type of weld desired.

The horns are made of cast copper, 24 in. in length, and are water cooled. Two lower horns are provided, one for welding longitudinal seams, the other for welding circular seams. The lower horn has a vertical adjustment of 4 in. while the minimum diameter of cylinder that can be welded longitudinally is 8 in. Special horns for both longitudinal and circular seams can be furnished, if desired.

The rollers are made of hard rolled copper and are mounted on hollow, water-cooled shafts or solid externally-cooled shafts. The rollers are designed to give long life but are easily removed for dressing or replacing. Particular care has been taken to insure correct mounting of the roller shafts and proper lubrication and cooling. The upper roller is mounted in the head, and can be turned at right angles for use with either longitudinal or circular seams. Pressure is obtained through a foot treadle and an adjustable spring controls the vertical movement of the upper roller. The maximum pressure applied on the rollers is 1,500 lb. The treadle is adjustable for length and upon being depressed automatically locks the rollers in the welding position. At the completion of the weld, another depression of the foot treadle automatically releases the head carrying the upper roller, thus allowing it to return to its open or resting position.



Thomson No. 375 Double-Roller Seam Welder

The transformer of the welder is rated at 100 kva. The secondary is made of cast copper and is water cooled, the water passing through seamless steel tubing cast integral with the secondary. The primary coils have taps connected to a regulator mounted on the frame of the welder, thus giving fifteen points of regulation.

Drive may be either by belt or by ½-hp. motor through a gear reduction unit. Change gears are furnished to obtain linear welding speeds of 6, 9, 12 and 15 ft. per minute. From the change gears, movement to the upper roller is provided through bevel gearing.

The machine occupies a floor space of 25x36 in. Its net weight is approximately 4,700 pounds.

"Lindy" General-Purpose, Flexible-Shaft Unit

The Stow Manufacturing Co., Inc., Binghamton, N. Y., has designed the "Lindy" flexible-shaft unit for die sinking, vulcanizing, sanding, filing and general finishing work on both wood and metals. The unit is for particular use with rotary files. It

"Lindy" Flexible-Shaft Unit

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is furnished complete as shown in the illustration with extension cord and plug and with a motor for use on 110-volt, 60-cycle, single-phase a.c. circuits.

The motor has a 3-step cone pulley, and three speeds are available on the flexible shaft of 900, 1,800 and 3,600 r.p.m. The unit has an overall height of 25 in. It can be provided with the following attachments: 4x1-in. wire scratch brush; 6x1-in. buff wheel; handless clamp spindle; sandpaper disk clamp spindle; ¼-in. chuck; "Jiffy" sanding wheel; offset angle head, and a 6x1-in. grinding wheel.

General Electric Atomic-Hydrogen Welding Outfit

BY THE use of atomic-hydrogen welding equipment placed on the market by the General Electric Co., Schenectady, N. Y., it is said that hitherto unweldable metals can be melted and fused without trace of oxidation, and welding can be performed in some cases on metals as thin as paper. This process makes possible the welding of many special alloys and the production of ductile welds in iron and steel. In brief, the method utilizes the passage of a stream of hydrogen gas through an arc between two electrodes. As they pass through this arc the hydrogen molecules are broken up into atoms. These atoms re-combine a short distance beyond the arc and in doing so liberate a large quantity of heat so that welding can be done effectively. The atomic hydrogen formed is a powerful reducing agent, so that alloys containing chromium, aluminum, silicon or manganese can be welded without fluxes and without surafce oxidation.

Fig. 1—General Electric Atomic-Hydrogen Welding Torch

The welding outfit consists of a welding torch, Fig. 1, by means of which the actual welding is performed, and, mounted on an instrument board, Figs. 2 and 3, a single-phase transformer for converting the voltage of a 60-cycle source of power to one suitable for the welding equipment and a specially-designed, variable reactor to provide the proper welding current and voltage for different classes of work.

The torch consists of a holder supporting two tungsten wire electrodes, the electric conductors connecting these electrodes to the reactor, and the tubing for the hydrogen gas. Each electrode is supported inside a nozzle through which the hydrogen gas is forced out around the electrode. The combination of electrodes and nozzles is set at an angle and the distance between electrodes, and the flow of gas are readily adjustable. The electric conductors to and through the torch are heavily insulated and when welding ceases, the welding circuit is automatically interrupted until such time as the operator is ready to weld again, when the circuit is automatically restored. There is no current flowing from the electrodes to the work to be welded, but instead the circuit is completed from one electrode to the other.

The reactor consists of a U-shaped core provided with pole faces between which a pivoted armature is arranged to move. The legs of the core have coils conected in series with the electrodes of the welding torch. The amount of welding current and voltage is governed by the movable armature which changes the air gap of the magnetic circuit and therefore the reactance. This armature is normally biased to an open position, and upon a flow of current through the coils of the reactor, is attracted to a closed position, which is adjustable by means of a handle and a suitable mechanism. When the arc is struck the armature automatically assumes the closed position and remains there until welding ceases.

In making edge welds, the metal to be welded is melted under the heat of the arc but when it is necessary to add additional metal, a filler rod must be used and fed into the arc in much the same maner as in gas welding.

The equipment is being marketed for operation from 60-cycle single-phase circuits only, and is recommended for use on ordinary metals of less than ¼ in. in thickness, or of greater thickness on hitherto unweldable metals. It is stated that work as thin as 2 mils can be welded.

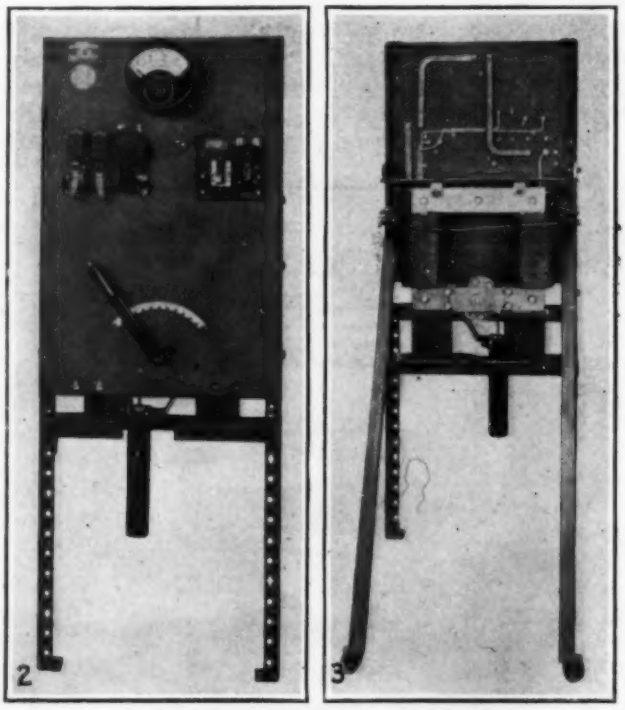


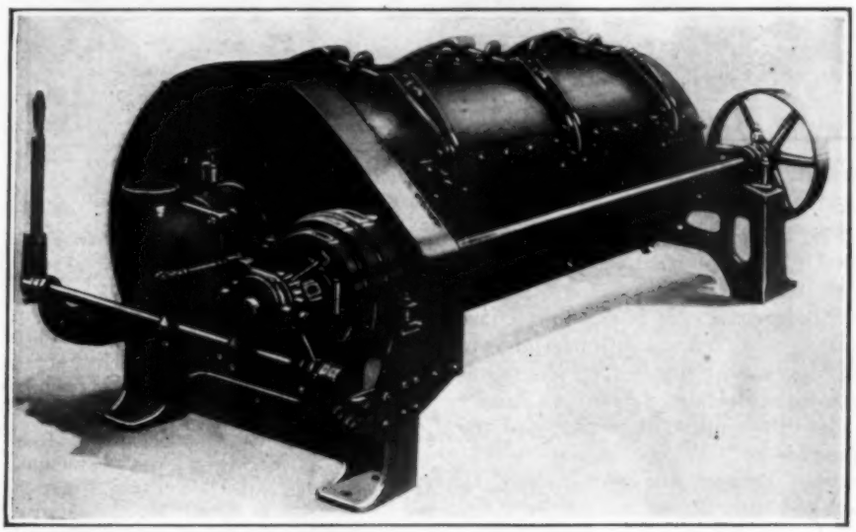
Fig. 2—Front view of the variable reactor panel for use with the antomic-hydrogen welding torch
Fig. 3—Rear view of the panel

Shop Equipment News

Whiting Tumbling Mill

THE tumbling mill shown in the illustration is the product of the Whiting Corporation, Harvey, Ill. It is claimed to be rugged in design and to exhibit several important improvements in this class of equipment.

A positive door clamp is featured. It consists of two or more pairs of cast-steel holding bars permanently mounted on the door. Each bar has a cast-steel toggle link or claw at its outer end which engages with cast-steel hooks riveted to the barrel at the edge of the door opening. With the door in place the claws are engaged with the hooks, and the tension bolts, connecting each pair of bars, are turned up tight. The links provide a toggle action that pinches the door edges tightly against the shell, while the tension in the bolts pulls the sides of the shell firmly together against the door. The door opening extends the full length of the barrel thus facilitating loading and unloading. The door itself is cut from the solid after rolling. When in place it is supported on all four edges.



Whiting Tumbling Mill

The shell of the mill is made of high-grade open-hearth steel, while the ends or heads of the barrel are heavy castings ribbed on the inside.

Each head is lined with an open-hearth steel plate, liberally perforated to permit free passage of the exhaust. This plate is bolted in place against the reinforcing ribs of the head. The construction of the unit is such that alignment in the head shell is assured.

The mill is designed to remove the dust and dirt promptly. With this end in view, the combined area of perforations in the head liner is equal to four times the area of the exhaust connection. The ribs on the inside of the head castings are also arranged to eject the dirt as it comes through the perforated liner plate. To present the least possible resistance to the passage of the exhausting air, the opening in the trunnions is made in a true venturi orifice. On leaving the trunnion the dust-laden air enters a substantial dust box or trap in which the heavier grit is deposited. The fine dust passes to the filter.

The trunnions on the Whiting mill turn on self-aligning bearings of the ball and socket type. The bearing itself is a solid cast-iron journal accurately bored and filled with grease. The drive shaft bearings are self-aligning, babbitted shells lubricated by compression grease cups. The drive is by belt to a friction clutch and helical gearing.

"Hallowell" Steel Trucks

The Hallowell steel trucks made by the Standard Pressed Steel Co., Jenkintown, Pa., can be furnished in eightwheel styles and forty different body designs for one chassis. The unit is of all-steel construction.

The top of the platform is made from a single piece of heavy steel plate with a deep integral flanged rib running around all four sides to provide a stiff section. The corners are welded. Pressed steel brackets, welded to the underside of the platform, hold the axle, while the swivel casters are bolted to a strong pressed steel base which is welded in place.

The feature of interchangeability has received special attention and it is said to be an easy matter to change a truck with wooden stakes into one

Fig. 1—"Hallowell" Steel Trucks with rack and bar handle

Shop Equipment News

with slatted steel racks, bar handles, plain steel stakes, or combinations of these, as desired. All kinds of fixtures suitable to accommodate stakes, racks or handles fit the corners of these platforms without modification.

The standard chassis is shown in Fig. 1 equipped with a rack bar handle. The six corner holes are identical for all chassis. The running gear of this type of truck consists of four semi-steel wheels, of which the two larger ones are mounted on a fixed axle, while two

Fig. 2—"Hallowell" Steel Wagon Trucks

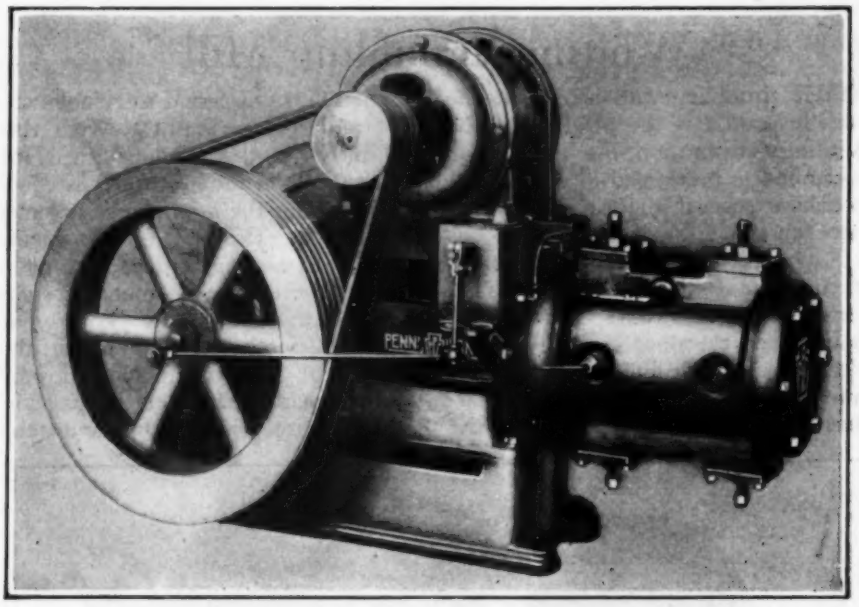
smaller ones are mounted on casters. The casters include an anti-friction thrust bearing of large diameter which works against a heavy pressed steel raceway. These steel casters are said to combine great load capacity with ease of swiveling. The semi-steel wheels are strong and dimensioned to suit the capacity of the truck. They can be furnished with either plain, rubber or canvas-cushion treads and with plain or roller bearings.

In Fig. 2 is shown the four-wheeled steel wagon truck. The two rear wheels run on a rigid axle, while the two front ones are mounted on a steel bolt which has a fifth wheel 4 in. in diameter. The wagon is manipulated by means of a T-handled pull-bar fastened to the bolster, as shown.

All styles of trucks are made in several sizes and in two capacities, 1,000 and 2,000 lb., respectively.

Pennsylvania Compressors with Texrope Drive

The Pennsylvania Pump & Compressor Co., Easton, Pa., recently equipped its horizontal, double-acting air compressors with Texrope drives manufactured by the Allis-Chalmers Mfg. Co. to reduce the floor space.



Pennsylvania Air Compressor with Texrope Drive

The drive consists of a number of flexible V-shaped rubber fabric belts operating in grooved sheaves, similar to a rope drive. It is possible to use short centers without slippage due to the V shape of the belt. No idler is necessary and the motor can be set in close proximity to the frame of the compressor. Where space is extremely limited, the motor may be mounted directly on top of the compressor frame, as no additional floor space is required.

Besides the minimum of floor space, inexpensive maintenance and quiet operation are also claimed.

Trade Catalogs

AIR COMPRESSORS, PORTABLE. The Pennsylvania Pump & Compressor Co., Easton, Pa., has issued Bulletin No. 133 on the Pennsy-Portable air compressor, Model 121. The publication is in leaflet form and is illustrated by several large photographs. A complete description of the unit is given, together with specifications.

BALL BEARINGS. The Strom Bearings Co., 4527 Palmer St., Chicago, Ill., has issued its latest catalog No. 11 on its products. Dimensional data and load ratings are given for each size and type of bearing. The line includes ball bearings of the deep-groove type, adaptor type, angular-contact type and thrust bearings. A price list is appended. The publication contains 112 4x7-in. pages and is illustrated with photographs and cross-sectional views.

BOWSER PRODUCTS. S. F. Bowser & Co., Inc., Fort Wayne, Ind., has published a little circular entitled "The World of Things that Bowser Does." This line includes petroleum storage equipment for use in garages, railroads, ships, industrial plants and stores, besides a miscellaneous lot of equipment.

CONVEYORS, BELT. The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., has published Data Book No. 615 on its belt conveyors. The book contains 148 pages and is attractively bound in flexible imitation-leather covers. The first part of the book is devoted to the design and selection of belt conveyor equipment, including the type of drive and the methods of figuring the power requirements. The design of conveyor idlers is next gone into in considerable detail. Among the miscellaneous equipment described are belt trippers, speed reducers and other transmission equipment. The catalog is well illustrated throughout.

MOTORS, SINGLE-PHASE. The Century Electric Co., St. Louis, Mo., has issued folder No. 652, describing the assembly of its repulsion-start induction, single-phase motors. This publication is one of a series describing particular features of this equipment. It is well illustrated with photographs of the various important parts.

WELDING EQUIPMENT. The International Oxygen Co., Newark, N. J., has issued Catalog No. 27 on its welding and cutting equipment. The publication contains twenty-four 8½x11-in. pages, and is well illustrated throughout. The line includes cutting and welding torches, regulators, hose fittings, acetylene generators, welding sets and miscellaneous equipment. Industrial gases are also included.

NEWS OF THE WEEK

Judge Elbert H. Gary, Head of Steel Corporation, Dies in New York

Lawyer, jurist and business organizer for 50 years

JUDGE ELBERT H. GARY, chairman of the board of the United States Steel Corporation, died at his home in New York City early on the morning of Aug. 15. Judge Gary had been in poor health for some time and his death was not entirely unexpected.

Elbert H. Gary was born on a farm near Wheaton, Ill., in 1846. He was educated in the public schools of Wheaton, and when the Civil War broke out was a student in the Illinois Institute. In 1864 he ran away from home and enlisted, but was returned home after a short period of service on account of his youth. After the close of the war, Mr. Gary taught school but soon decided to follow the practice of law. He went to Naperville where he entered the office of Col. Henry Valette, where he began his preparation for the legal profession. He entered the Union College of Law at Chicago and was graduated at the head of his class in 1868.

After serving a few years as clerk in the Superior Court he went into business for himself and was immediately successful. His colleagues at the bar induced him to run for the office of judge in Du Page County, and he served two terms in that capacity. His service as a county judge served to identify him throughout the rest of his life, for he was universally known as Judge Gary from that time on.

In 1892, when Judge Gary first became interested in steel and his career became identified in the public mind with the creation of the United States Steel Corporation and with its subsequent growth, he had been a practicing lawyer for twenty years. John W. Gates had come to be the most important single figure in the manufacture of barbed wire. In that year he came to Judge Gary to arrange the legal details of an amalgamation of competing manufacturers. The formation of the Consolidated Steel and Wire Co., a $4,000,000 corporation, followed. The panic of 1893 was close on the heels of the creation of the corporation and Judge Gary found himself giving business advice as well as legal counsel. Judge Gary bought stock in the corporation and became more and more identified with its interests.

In 1897 Gates broached to Gary the subject of an even greater amalgamation in the steel wire business. Negotiations that went on for weeks in New York and that were intended to lead to the formation of an $80,000,000 corporation, were only partially successful, and led, early in 1898, to the incorporation of the American Steel and Wire Co. There was no monetary profit in the affair for Judge Gary, but during the course of the negotiations he had won the complete confidence of J. Pierpont Morgan, which was to have an important bearing on his future.

Judge Elbert H. Gary

The Illinois Steel Co., established during the Civil War, had been in serious financial difficulties in 1893. Judge Gary had been called into consultation and had been made general counsel, the beginning of a close association with the board of directors. Only a few months after he had completed his work on the American Steel and Wire Co. organization he directed the amalgamation of the Illinois Steel Co. and the Minnesota Iron Co. under the name of the Federal Steel Co., a $200,000,000 corporation. When the work had been completed Judge Gary was summoned to the office of J. Pierpont Morgan, who had carried through the financing of the corporation, and was asked to become president of the Federal. Twenty-four hours later he had accepted, and started back for Chicago to close up his law office and prepare to move his home to New York.

Judge Gary took up his duties as president of the Federal Steel Corporation in October, 1898.

Following prolonged negotiations in which J. Pierpont Morgan and Judge Gary played the leading rôle, the United States Steel Corporation was formed from the Federal Steel Co., the Carnegie Steel Co., the National Tube Co., the American Steel and Wire Co., the American Bridge Co., the Lake Superior Consolidated Ore Mines, and the tin plate, steel hoop, and sheet steel companies. The new corporation was capitalized at $1,100,000,000 and had a bonded indebtedness of $300,000,000.

The billion dollar corporation began business on April 1, 1901, with Charles M. Schwab, a Carnegie man, as president, and Judge Gary as executive head. The company at that time controlled almost exactly half of the rolled steel products of the country. Judge Gary continued as executive head until 1903, when Schwab retired as president; W. E. Corey became president, and Gary chairman of the board of directors, a new position.

Under Judge Gary's direction the Steel Corporation grew to be a dominant factor in the industry.

Although hostile to the organization of unions among employees of the corporation, he was interested in the welfare of the Steel Corporation workers. He encouraged stock ownership among employees, and in the years when the corporation's income was lowest took a determined stand against reduction of wages. The Steel Corporation, at his behest, adopted the plan of voluntary compensation for injured workmen. The corporation under his guidance was a leader in the industrial safety movement and one of the first to inaugurate "Safety First" campaigns. Judge Gary took a leading part in the abolition of the twelve-hour day in the steel industry.

Judge Gary's leadership in the steel industry made him one of the most valuable of private citizens to the Government during the war.

While Judge Gary belonged to more than forty clubs and organizations, it was the American Iron and Steel Institute which won the greatest amount of his interest. The "Gary dinners," as the annual gatherings of the leaders of the industry were called, began in 1907, and their principal feature was always the address which Judge Gary made, outlining conditions and prospects of the business.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THERE are some pictures that are best viewed from a distance, and this is true of the present business situation. It is so complicated that it is difficult to synthesize it, except from a position of detachment.

The reduction in the rediscount rate in most Federal Reserve banks announced last week has not lifted the stock market, as many expected, and some highly speculative favorites have declined sensationally. The reason is that the continued increase in brokers' loans is regarded as a signal to slow down. Then, too, it is becoming apparent that we may soon export capital, and perhaps gold.

Interest rates here are now fully one per cent below London, and the disparity must lead to the withdrawal of the European credit balances hitherto carried in the United States.

The advance in sterling attests this. It is now at the highest of the year, and some bankers think it may go to the gold export point. Everyone is agreed that we have too much gold, but if it should commence to go out in quantity, the effect on speculation might not be altogether soothing.

Then there is the political outlook. The country has come to believe that Mr. Coolidge meant "I will not" when he said "I do not choose," and from now until November, 1928, there will be more or less uncertainty about who the next President will be.

Predictions that the farmers will demand a reduction in the tariff are to be heard in some quarters, and while the protected manufacturers disparage such talk, they don't like it. That these uncertainties are checking trade is becoming evident. For the four weeks ending July 30th, car loadings have been 5 per cent under last year.

Railway earnings for the first six months of the year are smaller than expected, and the net for June shows a decrease that is particularly disappointing. The passenger traffic is also smaller, and the Pullman car traffic in particular is commencing to reflect a decline in the expenditures of the well-to-do. Not a single one of the widely exploited railway consolidations is as yet consummated, and the delay plus the decrease in earnings and traffic is commencing to have its effect upon the minds of investors who bought railway stocks in the expectation of a carrier's millenium.

The effect that deferred hope has upon financial sentiment is apparent elsewhere in the investment market. But it is unnecessary to be specific. The Stock Exchange quotations as well as those of the Curb and Counter market speak for themselves. What has happened or seems about to happen has been anticipated in more than one of these letters. If its effect is not too seriously disturbing, no one except the speculators involved will suffer and their ultimate fate is pre-ordained. Some of those who foresaw the impending liquidation in the security market are turning their attention to commodities, in which the situation is more interesting.

Cotton, wheat, and corn are all substantially higher upon private or official reports that indicate reduced production. Cotton had a sensational advance on a government crop report whose credibility is seriously questioned. The effect has been to throw the dry goods market into confusion, and nearly one-third of the advance in cotton futures has been lost.

It is probable that the damage to grain has also been exaggerated, but the frost reported in Canada seems to have been real, and it is possible that the condition of wheat and corn is as bad as reported, although it seems doubtful. None of the other speculative commodities have changed much. Rubber is commencing to show the effect of the export restrictions, and has sold at over 36 cents. Sugar is slowly moving up. Well informed trade opinion is curiously confident that the next Cuban crop will be restricted to 4,000,000 tons. If this be true, higher prices would seem to be indicated. Coffee is yielding gradually as the prospective crop increases, but a further decline will be fought by coffee interests.

Raw wool is steady, but the American wool industry is in much the same case that our cotton manufacturers were a year ago. Hence a "Woolen Textile Institute" is being talked of.

Steel manufacturers say they are encouraged by the outlook, but no one seems excited about it, although "The Corporation" reports a slight increase in unfilled orders. Copper has been firm at around the highest prices touched during the past few months. A sharp decrease in building for July is admitted by some authorities, and as fall approaches, a lessening of activity in many other directions seems to be indicated by present signs.

In Europe, the outlook is satisfactory, and some improvement is reported now that an abundance of cheap American money is assured. If we are able to market our agricultural surplus abroad at present prices, a speedy revival in both our foreign and domestic trade will soon follow.

WHAT'S DOING IN INDUSTRY

EXPECTATION of a brisk fall trade has been the keynote in the machinery and machine tool industries in the last week, as indicated by inquiries and the September shows. In only one center, Detroit, no prospects are reported in sight, with the summer depression at its worst. Here the employment situation is bad due to thousands pouring into the city in advance of a Ford boom. In general, orders have been small, and in some centers none of any consequence have materialized.

CHICAGO looks to a revival of business in September with machinery now at a standstill. The railroads are not buying anything, and woodworking machinery is hard hit. Buffalo is in the same situation, the only active field being in electrical goods. In Cincinnati, inquiries indicate good volume of future business. Fall activities are also foreseen in Philadelphia due to an increase in mechanical repair work.

NEW ENGLAND, contrary to other sections, continues its summer activities. Some plants are busy on large orders, while in the typewriter industry vacations have been curtailed. As in Buffalo, electrical equipment is active. Of the western cities, Milwaukee is the most optimistic. Here business, although light, is better than last year, most orders being for replacement.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CINCINNATI

The majority of the machine tool manufacturers in the Cincinnati district report that in the past week the market was rather quiet, but a small number state that they were agreeably surprised by receiving quite a good volume of business. All state that the demand was better than in the same period last year and all feel that the outlook is in every way encouraging.

Selling agents state that, considering the fact that it was in the midst of the vacation season, business was very fair, it showing an increase over the same week of last year.

The backbone of the past week's business was the purchase of single tools and replacements by machinists and general users. The orders from these were well diversified in the matters of size and type and they were well scattered over the country. Concerns in the automotive industry bought a tool or two, and there were a few scattering orders from railroads.

The majority of the manufacturers report that inquiries came in quite freely during the week, from all sections of the country. The consensus is that the number and nature of these inquiries give great encouragement and clearly indicate an increased demand for all varieties of tools in the near future. Several manufacturers report that inquiries from the automotive field are becoming more numerous, and because of that fact expect that market to become livelier in the near future. Railroad inquiries received were largely confined to single tools and replacements.

PHILADELPHIA

During the last two weeks, the Philadelphia machinery and machine tool market presented a typical midsummer condition, with leaders of the industry forecasting a more substantial volume of trade by mid-September. Some inquiries came from western industries for slotters, and engineering firms engaged in mechanical repairs reported an upward trend, which they interpreted as indicative that industrial firms are looking to the early fall for resumption of business.

Some dealers reported that although the number of inquiries has been smaller during the last two months than in the corresponding period of last year, the percentage of orders from inquiries is holding up. Wholesale dealers in oils for heavy machinery reported some buying from the Detroit automobile centers. In certain parts of the trade a falling off in July orders compared to those for June is reported. The market for used machinery has not improved any.

BUFFALO

The machine tool trade in Buffalo is at the lowest ebb of the year. This condition is not expected to last but in the final reckoning August will doubtless show up as the worst month of the year.

Some business is being done, but it is spasmodic. The vacation season is held chiefly responsible for the condition, many pending orders being held up indefinitely during the vacation absences of industrial executives. The best reports are that business is no worse than the same period last year, while other reports state that it is much worse.

The electrical field seems to be better off than other divisions as a fairly steady stream of small orders for electrical equipment is coming in.

The contractors' equipment field is in a discouraging condition. Demand is low and price conditions are bad. While there is some reason for pessimism in this field, nearly everyone expects that within another thirty days—by the middle of September—the machine tool and allied trades in this territory will have taken a marked upward turn.

DETROIT

The depression in the Detroit machinery field is still unrelieved and is, in fact, a little worse in some respects than it has been during the past few weeks. One dealer in specialized equipment reports several large sales to four of the leading automobile manufacturers, but none of the others are getting any business and even the normal inquiries of the past month have dropped off.

The tool shops and the parts makers are almost all idle, and there is a general feeling that things will not pick up in the immediate future. Some dealers consider this the poorest month of a very poor year, but there are others who have found the month slightly better than July.

Ford, Paige, Chevrolet and Dodge are doing a little buying. The new Dodge four is going well and plans are being made to improve it and to increase its production. The plans for the new light six are nearing completion and will probably be announced soon. The work of preparing the new Ford car is going forward steadily and the interest of all the automobile world is still centered on its introduction.

Employment is slightly better than in July, but no noticeable improvement has taken place. The widespread stories and rumors of a Ford boom brought many thousands of men to Detroit. This movement merely added to the city's large army of unemployed, for neither Ford nor any of the other manufacturers are taking on any great numbers of new employees at this time.

CHICAGO

No improvement over conditions prevailing for the last two months in the machine tool market is reported from any source. Business is almost at a standstill in the local machinery industry, but indications are not lacking that there will be a gradual revival after the first days in September. Some of the leading dealers in machine tools are directing their efforts toward lining up prospective railroad business for 1928 and are getting advance information from several western roads as to what may be expected in next year's budgets. Inquiries are being received in fair number, but few of them are for immediate needs.

Manufacturers of and dealers in woodworking machinery are experiencing a period of dullness comparable with that felt in metal-working tools. This is largely attributed to inactivity in the furniture manufacturing industry, which is at an exceptionally low level.

Railroad buying is still limited largely to the closing of items on old lists, and practically no new business is in sight from this source. Dealers specializing in used tools report little doing in the way of sales, but are looking forward hopefully to an improved situation in the fall.

NEW ENGLAND

Part of the contract placed with Niles-Bement-Pond Co. by the Sorocaban Railway, of Brazil, for complete shop equipment will be placed with the Pratt & Whitney Co., in Hartford. This, together with machinery in production for the arsenal equipment for Japan, gives this company a fair volume of business, when taken together with the general run of orders.

The River plant of the Westinghouse Co. at Chicopee Falls, Mass., is progressing rapidly and operations in production of radio parts will shortly be proceeding. Additions to the working force will be made from time to time as manufacturing facilities permit.

Business in machinery for electrical manufacture has recently been fairly active and a substantial amount is represented in the inquiry mail.

Although this is the vacation season in the typewriter industry, some of the plants have found it necessary to curtail these schedules to meet demands, which have been greater than usual.

MILWAUKEE

While the call for metalworking equipment continues light, there is no note of discouragement discernable in the comments of manufacturers or dealers. Business is probably less active than a year ago, but while at that time the future outlook was beginning to assume a darker hue, the trend at present appears to be in the other and, consequently, more favorable direction. August usually is a slow month for sales as well as production, so that the absence of volume buying is not considered of much significance in the present analysis.

The character of inquiry is improving, and although no request for prices and deliveries involves any sizable quantities, the aggregate represented is fair. The major share of inquiry is for tools for replacement of obsolete or worn-out machinery, but here and there a manufacturer seeks one or two tools in order to provide somewhat greater capacity. The absence of important industrial plant construction projects robs the market of large lot possibilities. On the other hand, general industries report a slow but steady improvement in their orders and the time is believed to be not far off when additional capacity will be required to handle the run of business properly.

General comment on the business situation is much more optimistic than it has been for several months, due to the rising activity of trade, and the outlook for fall and winter is unquestionably far better than it was a year ago.

A recent report of the Bureau of Mines states that there are 62,000,000 tons of coal in the hands of consumers. The bureau has received authentic statements to the effect that nearly fifty million tons are held by about five thousand consumers.

French Trade, Finance and Industry Await Assured Stabilization

Exports show increase to United States, England, and Germany

By Our Paris Correspondent

IT IS now generally conceded that stabilization of business in France is farther off than was first thought. Not even the quasi-stabilized franc at twenty five to the dollar longer is admitted as a possible panacea for industrial and business ills.

The tariff issue is ever hanging fire. If French locomotive, rolling stock and agricultural machine makers are demanding stiffer tariff protection, the silk, soap and perfume makers suggest that the boomerang is liable to fly back and hit them. Nevertheless the long postponed new tariff is bound one day soon to come into operation, but until it does, or at least, until it is announced, foreign trade relations are bound to be unstable.

France was making great headway with her export of small automobiles but figures have dropped during the first six months of the present year from 1,300,-572,000 francs to 656,060,000 francs. Spain has been the largest individual buyer during the last six months, having largely increased its purchases, while other countries—Great Britain and Switzerland, where American cars are still increasing in numbers—have greatly curtailed their imports from France.

Results of Poincairé Regime

Much is being made of the possibility of a positive business stabilization by reason of the success of the twelve-month national union of political points of view as shown by the recent Poincaré balance sheet. This shows gold and gold credits now available to government call to the value of 23,460,000,000 francs.

All this is a matter of national politico-financial improvement based on the efforts made by the Poincaré government. Actually the business aspect is something quite different as shown by the first six months' foreign trade figures and the slight wobbling of the franc in the money market following upon the publication of the balance sheet.

There are somewhat surprising comparisons in French export and import figures applying to the first half of the present year as compared with the same period in 1926. Imports fell off rather more than two billion francs in value. Those from Great Britain and the United States showed notable decreases, the latter to the extent of 248,243,000 francs, while the increase to be credited to Germany was 214,000,000 francs.

Exports to the United States increased 66,000,000 francs, to England nearly four-hundred million, to Germany a billion and a quarter, but fell off four-hundred millions to Italy, the latter a result of the half-closed foreign policy of Italy. Total exports for the period increased 215,821,000 francs. The franc value exports of last year however were based on a lower gold value than this year so the figures otherwise might not even show this increase. Both imports and export relations with the French colonies and protectorates also show a falling off.

Railway material manufacturers are admitting a crisis in their industry and seeking a remedy. The last annual report of their association makes known that from 1904 to 1914 locomotive plants increased their productive capacity 100 per cent, and rolling stock plants, 50 per cent. Orders since the war have been by no means sufficient to allow of profit-making operations, when taxation on business, heavy carrying charges and overhead with plants but partially occupied is considered. In recent years orders have been forthcoming for only 25 per cent of the capacity of locomotive plants, 20 per cent for passenger cars and 15 per cent for freight cars.

The nut and bolt industry is quiet in spite of a competitive price cutting which was unlooked for. Stocks are being accumulated. Steel construction elements are finding some demand for public works, bridge construction and electric installations. Some orders for rolling stock have been placed by the railways, counting in all perhaps five hundred units, chiefly of freight cars. Machine wire is being dumped on the market, believed to be of German origin and a price break is looked for if the German inspired international cartel cannot, or will not, call a halt. French wire drawers have, however, increased prices 2.50 francs per 100 kg. The Versailles arsenal has placed a miscellaneous order for small shop tools and there has been some slight buying in other quarters but the machinery and tool trade in general may be said to be at its lowest level of the year.

Standardization

The Society of Automobile Engineers has formed a committee to study methods of application of standardization in the automobile industry where it is recognized that production costs have not been brought down in line with those in the United States.

The Féderation Française de la Mécanique and the Comité des Forges have also been investigating methods in detail and elaborating a program for their members where such can be applied in their industries. It is believed that one day an international accord may be arrived at between Belgium, Luxembourg and Germany on many common points of standardization in the metal-working trades.

A new organization has been created in Paris known as the Centre d'Information du Nickel. It is to be a bureau of information of all kinds concerning nickel and this information will be made public to inquirers upon request. M. Leon Guillet is president of the institution.

Another campaign echo against American machinery repair parts has been heard these last days. It is claimed that advantage is taken of the foreign buyer by selling him rough castings at 42,000 francs a ton. Another claim was that a part for an American-made tool, which might originally have carried the price of a dollar in the land of its birth, was sold here for nearly seventy francs. The argument certainly does not hold good for certain American automobile parts and no protest is made that this is general but the "knock" is there just the same.

The French agricultural Machinery Syndicates are to hold a joint exhibition of agricultural machinery under the patronage of the minister of agriculture in Paris in January, by which time it is expected that the new tariff bill, which was side tracked by the last parliamentary session, will have come into being with a protective clause of benefit to the home industry.

Employment Conditions

Employment conditions are not wholly satisfactory, though numbers of those who would otherwise be unemployed have been absorbed by the farming districts for the harvest, the bulk of whom will be thrown back to the towns as winter approaches. Labor otherwise has found itself over abundant. Reconstruction demand have been all but eliminated, stocks have been allowed to accumulate and export trade has shrunk to lower tonnage levels. With all this it may be said that the general economic situation is at least as satisfactory as that of England, Germany, Italy or Austria.

The period of economic reconstruction has arrived, as was predicted in a recent forecast by a prominent French economist. The Geneva Economic Conference suggested more forcefully that this condition was at hand.

It is claimed in some quarters that failures are becoming potentially more iminent than has been noticed for three years, but not with respect to major producers. Trading activities outside foodstuffs and clothing are certainly not marked by any great visibility though prices are being shaved here and there of odd centimes, something which shows in the aggregate but not appreciably in individual cases.

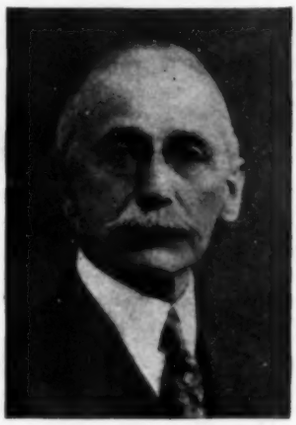
Unemployment in the metal and machinery trades in the Paris district on August 1 registered 2,078; in woodworking industries, 942; building trades, 521, and laborers 3,385.

There are now 278 official unemployed "funds" available to the unemployed. During the midyear crisis in 1921 there were registered by government offices 84,810 unemployed; the corresponding figure for the same period this year is 17,583 persons.

Dr. Humphreys Dies at Morristown

Dr. Alexander Crombie Humphreys, who retired last July as president of Stevens Institute of Technology after twenty-five years' service, died on Aug. 14 at his home in Morristown, N. J. He was an engineer of the first rank, having been chief executive of fifty gas and electric companies. Dr. Humphreys was born March 30, 1851, in Edinburgh, Scotland.

From 1902 to 1927 Dr. Humphreys was president of Stevens Institute of Technology and remained as chairman at the time of his death. He held degrees from the University of Pennsylvania,



Dr. Alexander C. Humphreys

New York University, Columbia University, Brown University, Rutgers University and Rensselaer Polytechnic Institute.

He was a former president of the American Institute of Consulting Engineers, the American Society of Mechanical Engineers, the American Gas Institute, the Canadian Society of New York, the American Gas Light Association, the Engineers' Club and the St. Andrews Society; and was a member of the United Engineering Society, the National Society for the Promotion of Industrial Education, the American Association for the Advancement of Science, the British Association for the Advancement of Science, the Society for the Promotion of Engineering Education, the American Society of Mining and Metallurgical Engineers, the American Society of Civil Engineers, the Institution of Civil Engineers of Great Britain.

Business Items

W. O. Taylor & Co., Ltd., of 415 Canada Cement Bldg., Montreal, Canada, have been appointed representatives in Canada for the Allen-Bradley Co., of Milwaukee.

The Wright Manufacturing Co., Lisbon, Ohio, announces the removal of its Chicago office to 548 W. Washington Boulevard.

The Philadelphia Gear Works announce that on September first they will occupy their new and modern plant at Erie Ave., and G St., in Philadelphia. The old plant is located at Richmond and Tioga Sts.

The Surface Combustion Co. announces the removal of its plant from Gerard Ave., Bronx, N. Y., to 2369 Dorr St., Toledo, Ohio. District sales offices will be maintained at 366 Gerard Ave., in New York.

H. O. Swoboda, Inc., 3400 Forbes St., Pittsburgh, Pa., has arranged with the Hevi Duty Electric Co., of Milwaukee, Wis., to represent its line of electrical furnaces for industrial and laboratory use.

The Earle Gear and Machine Co., Philadelphia, Pa., announces the opening of a district office at 95 Liberty St., New York, N. Y. C. N. Walsh and George E. Barrett are in charge. The company also maintains a district office at 110 State St., Boston, Mass., in charge of Wm. H. Allen.

The Breckenridge Machine Co., of Cleveland, Ohio, manufacturer of special machinery, has moved into a newly acquired plant at 1071 East 222nd St. in Cleveland. This company has for several years been occupying the Colburn Machine Works on Ivanhoe Road. A large amount of equipment has been purchased and installed in the new location and production is under way. The officers of the company are: H. W. Breckenridge, president; A. A. Geck, vice-president; W. E. Barrow, secretary and treasurer.

Personals

W. R. **Bean,** formerly research engineer for the Eastern Malleable Iron Co., has been appointed vice-president and consulting engineer for the Grindle Fuel Equipment Co., of Harvey, Ill.

Charles A. **Perryman,** formerly sales manager of the wire rope department of the Wickwire Spencer Steel Co., is now assistant sales manager of the American Cable Co. He is located at the company's New York office at 105 Hudson St.

Raymond Wilson, assistant resident accountant of the Delco-Remy Corporation at Anderson, Ind., will be sent to Oaku, Japan, as a representative of the General Motors Export Co. I. C. Hartzell will succeed Mr. Wilson at the Anderson plant.

J. B. **Hamilton,** for about twenty years associated with the Wickes Machinery Co., of Jersey City, N. J., has retired as vice-president of that company and has become associated with the C. W. Pritchard Co., of Jersey City. The latter company deals in machine tools and construction equipment.

Arthur Pierce has been appointed New England representative of the Barnes Drill Co., Rockford, Ill., and for the Sundstrand Machine Tool Co. of the same city. Mr. Pierce was formerly with Manning, Maxwell & Moore, Inc., in Boston. His present address is 35 Lowell St., Melrose, Mass.

H. S. **Kartsher** has resigned as supervisor of shop engineering standards for the White Motor Co. He has opened offices under the firm name "K" Standards Service, at Cleveland Heights, Ohio, and will specialize in engineering standardization problems.

Daniel W. Northrup was recently elected president and general manager of the Henry G. Thompson & Son Co., New Haven, Conn., to succeed D. C. Smyth, who has been elected secretary of the company. Mr. Northrup was connected with the Bassett Metal Goods Co., Inc., Shelton, Conn., for the past twenty-five years, the last ten as vice-president.

W. J. **Laining,** foreign sales manager of the Advance-Rumely Co., Laporte, Ind., has just returned from a three months' trip in Africa. While there he introduced combines in Algeria. He predicted a growing demand for farm implement machinery manufactured in the United States for all the African colonies and also a bright future for the tractor on that continent.

John A. Mansergh, of Los Angeles, Cal., has been appointed sales manager of the Russell & Erwin Division of the American Hardware Co., New Britain, Conn., to succeed Isaac Black, who became general manager at the death of B. A. Hawley. W. Manville Johnson, Haworth, N. J., has been named assistant to the general manager. Mr. Mansergh has been connected with the Russell & Erwin Division for the past year. He was formerly with Kelly-Howe-Thompson Co. of Duluth, Minn. Mr. Johnson is a graduate of Cornell University. He has been connected with the office of President Loree of the Delaware & Hudson Railroad Company.

Forthcoming Meetings

Steel and Power Show. First Steel and Power Show in the Varsity Arena, Toronto, Canada, sponsored by the Montreal and Toronto Chapters of the American Society for Steel Treating; by the Canada, Toronto and Hamilton Councils of the Universal Craftsmen's Council of Engineers; by the Engineers' Mutual Benefit Fund; the American Electroplaters' Society; and the Canadian section of the American Welding Society. Aug. 31 to Sept. 2. General chairman, C. Bradshaw, 153 University Ave., Toronto, Canada.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Society of Automotive Engineers. Production Meeting, starting at Hotel Winton, Cleveland, Sept. 19 and 20; continuing at Hotel Statler, Detroit, Sept. 21 and 22. C. E. Heywood, manager of meetings, 29 West 39th St., New York City.

American Welding Society. Fall meeting, Book-Cadillac Hotel, Detroit, Sept. 19 to 23. M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals. Sectional meeting, Hotel Statler, Detroit, Sept. 19 to 23. H. Foster Bain, general secretary, 29 West 39th St., New York City.

National Steel and Machine Tool Exposition. Under the auspices of the American Society for Steel Treating. Convention Hall, Detroit, Sept. 19 to 23. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Machine Tool Builders' Exposition. First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, Pennsylvania Bldg., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Building, Cincinnati, Ohio.

American Institute of Steel Construction. Annual convention at Pinehurst, North Carolina, Oct. 25 to 29. Charles F. Abbott, executive director, 285 Madison Ave., New York City.

National Association of Manufacturers. Annual convention, Read House, Chattanooga, Tenn., Oct. 25, 26 and 27. George S. Doudinot, secretary, 50 Church St., New York City.

American Society of Mechanical Engineers. National management meeting, Rochester, N. Y., Oct. 26-27. Charles W. Lytle, chairman, Management Div., 29 W. 39th St., New York City.

National Founders Association. Convention, Hotel Astor, New York, N. Y., Nov. 16-17. J. M. Taylor, secretary, 22 S. La Salle St., Chicago.

National Exposition of Power and Mechanical Engineering. Sixth annual event in the Grand Central Palace, New York, Dec. 5 to 10. Charles F. Roth, manager, Grand Central Palace, New York City.

Motor and Accessory Manufacturers Association. Annual meeting, New York City, Jan. 11, 1928. M. L. Heminway, general manager, 250 W. 57th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

DEFINITE stiffening of the market for non-ferrous materials appears this week in the higher prices asked for solder, babbitt metal and scrap brass, copper and lead. Improvement is noted in demand for steel structurals, bars, sheets, and wire rods. This condition is in contrast with the present low price of pig iron and retarded buying of automotive Material. Cast-iron pipe at principal producing center, is at present, $1 per ton under the extreme low point of the depression year 1921. Steel shapes, plates and bars hold at $1.80 per 100 lb., base, Pittsburgh mill.

(All prices as of Aug. 12)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	17.75
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.25	3.50	3.25	3.89
No. 12	2.30	3.55	3.30	3.94
No. 14	2.35	3.60	3.35	3.99
No. 16	2.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.80	3.75	3.55	4.00
No. 22	2.95	3.90	3.70	4.15
No. 24	3.00	3.95	3.75	4.20
No. 26	3.10	4.05	3.85	4.30
No. 28	3.25	4.20	4.00	4.45
Galvanized				
No. 10	3.15	4.10	3.95	4.25
Nos. 12 to 14	3.25	4.20	4.05	4.35
No. 16	3.35	4.30	4.15	4.45
No. 18	3.50	4.45	4.30	4.60
No. 20	3.65	4.60	4.45	4.75
No. 22	3.70	4.65	4.50	4.80
No. 24	3.85	4.80	4.65	4.95
No. 26	4.05	5.05	4.90	5.20
No. 28	4.30	5.30	5.15	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.65	3.60
Cold drawn flats, squares	4.50	4.15	4.10
Structural shapes (base)	3.34	3.00	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.65	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@½-in. thick.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			14.62½
Tin, pigs, 5-ton lots, New York			66.75
Lead, pigs, up to carlots, E. St. Louis 6.50		New York	7.37½
Zinc, slabs, up to carlots, E. St. Louis 6.37½		New York	7.25

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	15.00	17.50	13.00
Copper sheets, base	21.75	22.00	21.75
Copper wire, base	18.50	18.75	15.00*
Copper bars, base	21.25	21.50	21.25
Copper tubing, base	23.75	24.62½	23.75
Brass sheets, high, base	18.00	18.25	18.00
Brass tubing, high, base	22.87½	23.12½	22.87½
Brass rods, high, base	15.75	16.00	15.75
Brass wire, high, base	18.50	18.75	18.50

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	11.00	11.55	10.11
Solder (½ and ½), (case lots)	40.00	40.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	83.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	13.00

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	39.00
Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.50 @11.75	10.75	10.25@10.75
Copper, heavy, and wire	10.75 @11.25	10.75	10.00@10.50
Copper, light, and bottoms	9.50 @10.00	9.25	9.00@ 9.50
Heavy lead	5.37½@ 5.62½	5.75	5.00@ 5.50
Tea lead	4.37½@ 4.62½	3.75	4.00@ 4.50
Brass, heavy, yellow	7.37½@ 7.62½	7.00	6.75@ 7.25
Brass, heavy, red	8.75 @ 9.25	9.50	9.00@ 9.50
Brass, light	5.50 @ 6.00	6.00	6.00@ 6.50
No. 1 yellow rod turnings	7.25 @ 7.75	7.00	7.00@ 7.50
Zinc	3.75 @ 4.00	3.25	3.00@ 3.50

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
'AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.15½	36.00 per M	15
Sal soda, per lb	03½	02	02¾
Roll sulphur, per lb	027	03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	84	.91	.83½
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	65	.50	50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	27	.35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	30–10–5%
Heavy grade	30–10%	30–10%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb	.1575	.1525	.1712½
Solder (½ and ½)	per lb.	40	.40	.41
Cotton waste, white	per lb.	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	27	.33	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicag
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	3.00@3.25
Coke, prompt foundry, per net ton		Connellsville,	4.25@4.75
White lead, dry or in oil,	100 lb. kegs	New York,	13.75
Red lead, dry,	100 lb. kegs	New York,	13.75
Red lead, in oil,	100 lb. kegs	New York,	15.25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Broken Kegs or Cases	Full Kegs or Cases
Machine bolts, square heads and nuts:		
Up to ¾ x 6-in	50%	50–10%
Larger up to 1 x 30-in	45%	50%
1¼ and 1½ in. dia	30%	35%
Carriage bolts:		
Up to ½ x 6-in	50–10%	.....
Larger sizes	50%	.....
Coach and lag screws:		
Up to ½ x 6-in	50–10%	.....
Larger sizes	50%	.....
Tap bolts, hexagonal heads	45%	.....
Nuts:		
Hot pressed, square and hexagonal, blank or tapped	45%	50–10%
Cold punched, square and hexagonal, blank or tapped	45%	50–10%
Semi-finished, hexagonal, tapped, in packages	40%	.....
Case hardened, hexagonal, tapped, in packages	30%	.....
Washers: Deduct from list, per 100 lb.	$1.50	$3.50
Rivets, button and cone head:		
Small, including ⅞-in. dia	.....	50–10%
Large (base) per 100 lb	$6.50	$5.00

EXTRA per 100 lb. on rivets: For ½-in dia., 35c.; ⅝-in., 15c.; 1-in., 5c.; length 1-in. and shorter, 25c.; longer than 1-in. up to and including 1 ½-in., 15c.; longer than 5-in., 25c.; standard countersunk head, 25c.

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—Bureau of Supplies & Accounts, Navy Dept.—will receive bids until Aug. 23 for sheet metal cutters.

Mass., Cambridge (Boston P. O.)—McSorley Bros., 456 Broadway—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $45,000.

Mass., Fall River—D. J. Dennis, 62 Sixth St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $45,000.

Mass., New Bedford—City, W. P. Hammersley, Municipal Bldg. — miscellaneous tools and equipment for proposed 2 story machine shop and garage. Estimated cost $50,000.

Mich., Detroit—Allen Electric Co., 858 West Fort St.—lathe and equipment for proposed repair shop.

Mo., St. Louis—Bd. of Public Service, L. Day, Comr., City Hall, will receive bids until Sept. 6 for a gasoline operated full revolving crawler crane for waterworks at Howard's Bend, on the Missouri River.

N. Y., New York—Supt. of Plant Operation of Bd. of Education, Room 614, 131 Livingston St., Brooklyn will receive bids until Aug. 22 for automobile shop equipment for Haaren High School, also equipmen for sheet metal and printing shops for P. S. 30, here.

N. Y., Rochester—H. E. Kirstein, 1420 Temple Bldg.—hopper feeding device to feed small nails or rivets.

Tex., San Antonio—Goad Motor Co.—lathe, drill press, threading machine, etc. for proposed 2 story, 165 x 167 ft. garage. Estimated cost $125,000.

Ont., Elmira—Link Belt Ltd., 310 West Pershing Rd., Chicago, Ill., A. H. Vice, Local Mgr.—new equipment for recently acquired foundry, here.

Opportunities for Future Business

Calif., Pacific Grove—American Can Co., Hunter-Dulin Bldg., San Francisco, will build a 1 and 2 story factory and warehouse here. Estimated cost $600,000.

Calif., San Francisco—Pacific Can Co., 290 Division St., will build a factory at Newhall St. and Williams Ave. Estimated cost $100,000. Work will be done under the supervision of L. H. Nishkian, Monadnock Bldg., Engr.

Calif., Stockton — Graham Bros., manufacturers of motor trucks, awarded contract for the construction of a 1 story, 90 x 540 ft. assembly plant. Estimated cost $150,000.

Colo., Minnequa (mail Pueblo)—Colorado Fuel & Iron Co., E. H. Weitzel, Gen. Mgr., Pueblo, plans the construction of a pipe foundry here. Estimated cost $1,000,000. F. L. Lindemuth, Pueblo, Ch. Engr.

Conn., Waterbury — American Fastener Co., 54 Maple St., is having plans prepared for the construction of a 5 story factory. Estimated cost to exceed $40,000. C. J. Bailey, 63 Bank St., Archt.

Ind., Anderson—Cleveland, Cincinnati, Chicago & St. Louis Ry., 230 East 9th St., Cincinnati, O., awarded contract for the construction of a roundhouse and service building here. H. Baldwin, Ch. Engr. Noted July 28.

La., New Orleans—The New Orleans Car Wheel Co. Inc., recently incorporated at $500,000, has work under way on the construction of a plant for the manufacture of railroad wheels.

Me., Saco—York County Motor Corp., c/o J. S. Stickney, Archt., awarded contract for the construction of a 1 story repair and service garage. Estimated cost $40,000.

Mass., Boston—Argonaut Realty Corp., H. C. Hickey, Mgr., General Motors Bldg., Detroit, Mich., is receiving bids for the construction of a 2 story sales and service station at North Beacon St., here. A. Kahn Inc., Marquette Bldg., Detroit, Mich., Archt. Cadillac Motor Car Co., lessee.

Mass., Boston—Back Bay Hotels Garage Inc., 260 Tremont St., awarded contract for the construction of a 3 story garage at Columbus Ave. and Dartmouth St. Estimated cost $500,000. Noted Aug. 4.

Mass., Boston—A. J. Carpenter, Massachusetts Hill Rd., Jamaica Plain, Archt., is preparing plans for the construction of a 1 story repair and service garage on Willow St., here. Estimated cost $40,000. Owners name withheld.

Mass., Boston—Meisel Press Mfg. Co., Dorchester Ave., will soon award contract for the construction of a 1 and 2 story, 100 x 225 ft. plant at Dorchester St. and Crescent Ave. Noted Aug. 11.

Mass., Hyde Park (Boston P. O.)—F. Kinkel & Son, 10 Wolcott St., awarded contract for the construction of a 1 story blacksmith shop.

Mass., Lowell—T. F. Clark, 33 Oak St., awarded contract for the construction of a 1 story garage and repair shop on Howe St. Estimated cost $40,000.

Mass., New Bedford—City, W. P. Hammersley, Supt. of Building Dept., Municipal Bldg., is receiving bids for the construction of a 1 story machine shop and garage on Smith St. Estimated cost $50,000. L. La Brode, 888 Purchase St., Archt.

Mass., North Attleboro—Raymond Cooperage Co., Smithfield Ave., Pawtucket, R. I., plans the construction of a plant here. Architect not selected.

Mass., North Attleboro—Universial Car Co., Attleboro, plans the construction of a repair shop, etc. on South Main St. here. Estimated cost $50,000. Architect not selected.

Mass., Roxbury (Boston P. O.)—S. Rudnick, c/o Eisenberg & Feer, 46 Cornhill, Boston, Archts., awarded contract for the construction of a 1 story, 55 x 185 ft. repair and service garage at 1322 Tremont St. here. Estimated cost $75,000 to $100,000. Noted Dec. 30, 1926.

Mass., Winchester—W. R. Marshall, 19 Ridgefield Rd., plans the construction of a 1 story, 90 x 150 ft. repair and service garage at 36 Church St. Estimated cost $45,000. Private plans.

Miss., Jackson—Robinson Bros. Motor Co., plans the construction of a 2 story, 94 x 153 ft. garage. E. J. Hull, Merchants Bank Bldg., Archt and Engr.

N. J., Camden—Edwards & Green, 548 Federal St., Archt., will receive bids until Aug. 25 for the construction of a 2 story, 74 x 100 ft. garage at Haddon and Euclid Aves. for Camden Motors Co., 525 Market St.

N. J., Pensauken (mail Merchantville)—Bd. of Freeholders of Camden County, will receive bids until Aug. 22 for the construction of a vocational school including five 2 story, 62 x 100 ft. shops, etc. at Browning Rd. and Marlton Pike. Lockey & Hettle, 5 Hudson Ave., Camden, Archts.

O., Canton — Central Alloy Steel Corp., manufacturers of steel lath and other products, awarded contract for the construction of a 1 story, 160 x 420 ft. factory to replace fire loss. Estimated cost $75,000. Noted Apr. 14.

O., Chillicothe — Dept. of Highways & Public Works, Ohio-Hartman Bldg., awarded contract for the construction of a 1 story garage. Estimated cost $42,720.

O., Cleveland — The Cleveland Railway Co., C. Stanley, Purch. Agt., Hanna Bldg., is having plans prepared for the construction of a 2 and 3 story garage, etc. at Central Ave. and East 10th St. Estimated cost $200,000. Wilbur Watson & Associates, 4614 Prospect Ave., Archts. Noted June 23.

O., Columbus — Columbus Merchants Garage Co., W. T. Thompson, Pres., 98 North Front St., awarded contract for the construction of a 6 story, 125 x 187 ft. garage. Estimated cost $335,000.

Pa., Jenkintown—R. W. Cook, 250 South 18th St., Philadelphia, will soon award contract for the construction of a 2 story, 50 x 222 ft. sales and service station at 708 Greenwood Ave. here. Estimated cost $150,000. P. S. Tyre, 114 South 15th St., Philadelphia, Archt.

Pa., Philadelphia—General Electric Co., Witherspoon Bldg., will build a 1 story, 141 x 554 ft. plant at Elmwood Ave. and 67th to 70th Sts. Estimated cost $400,000. Harris & Richards, Drexel Bldg., Archts. Noted June 16.

Pa., Philadelphia—J. G. Lorenz Corp., 1011 Chestnut St., will soon award contract for the construction of a 1 and 2 story, 50 x 268, 40 x 97, 33 x 97, 32 x 33 ft. factory and warehouse at 33rd and Reed Sts. Estimated cost $100,000. Private plans.

Pa., Philadelphia — Roberts - Nash Co., Broad and Thompson Sts., awarded contract for the construction of a 5 story, 52 x 160 ft. addition to sales and service station. Estimated cost $300,000. Noted Aug. 4.

Pa., Pittsburgh—Chaplin Fulton Mfg. Co., 28 Penn Ave., is having plans prepared for the construction of a 3 story, 32 x 110 ft. addition to brass foundry. Estimated cost $100,000. B. H. Prack, Martin Bldg., Archt.

R. I., Providence—H. K. Noyes & Son, Inc., 857 Commonwealth Ave., Boston, Mass., will build a 2 story, 90 x 123 ft. repair shop and sales and service station at 9 Reservoir Ave. here. Estimated cost $185,000. Private plans.

Tenn., Memphis—U. S. Veterans Bureau, Arlington Bldg., Washington, D. C., will receive bids until Sept. 3, for the construction of new shops, etc. at U. S. Veterans Hospital here.

Tenn., Yale — St. Louis — San Francisco R.R., St. Louis, Mo., awarded contract for the superstructure of a machine shop, wheel shop, etc., here. Estimated cost $64,000.

Tex., Dallas—The Guiberson Corp., N. G. Guiberson, Treas., manufacturers of oil well machinery and supplies, plans extensions and improvements to plant to double the capacity.

Tex., Dallas—The Mosher Steel & Machinery Co., W. S. Mosher, Pres., has acquired a site and plans the construction of machine, pattern and blacksmith shops, etc. at Dallas St. and Maple Ave. Rd. Estimated cost $500,000.

Tex., Dallas—The Murray Co., 3200 Williams St., plans extensions and improvements to foundry and machine shop. Estimated cost $100,000.

Tex., Mount Pleasant—G. C. Ehemann & Co., Memphis, Tenn., are having preliminary plans prepared for the construction of a hardwood mill here. Estimated cost $75,000. Private plans.

Tex., Dallas—Prest-O-Lite Co., 30 East 42nd St., New York, N. Y., has acquired a site and plans the construction of two buildings 2 and 3 story for industrial plant here. Estimated cost $200,000.

Wash., Tacoma—Jones & Co., 106 Rust Bldg., plans the construction of a 60 x 300 ft. steel plant. Estimated cost $200,000.

Wis., Milwaukee—J. T. Ellison, 528 Summit Ave., is having plans prepared for the construction of a 1 story, 375 x 450 ft. garage on Wisconsin Ave. Rosman & Wierdsma, 495 Broadway, Archts.

Wis., Milwaukee—Longemann Bros. Co., 3030 Burleigh St., plans the construction of a 1 story, 50 x 200 ft. press manufacturing plant. Estimated cost $60,000. E. R. Liebert, 49 East Wells St., Archt.